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ENVIRONMENTAL ASSESSMENT BOARD



ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

VOLUME: 131

DATE: Thursday, April 9, 1992

BEFORE:

HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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ENVIRONMENTAL ASSESSMENT BOARD
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,
R.S.O. 1980, c. 140, as amended, and Regulations
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro
consisting of a program in respect of activities
associated with meeting future electricity
requirements in Ontario.

Held on the 5th Floor, 2200
Yonge Street, Toronto, Ontario,
Thursday, the 9th day of April,
1992, commencing at 10:00 a.m.


VOLUME 131

B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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1 ---Upon commencing at 10:02 a.m.

2 THE REGISTRAR: Please come to order.

3 This hearing is again in session. Please be seated.

4 THE CHAIRMAN: I think, Ms. Harvie, there
5 are a couple of exhibits that have to be put into the
6 record? I don't have a note of them, but I think there
7 are two; are there not, Mr. Lucas?

8 THE REGISTRAR: Yes, 591 and 592.

9 THE CHAIRMAN: 591 is...?

10 THE REGISTRAR: This has been entered.

11 THE CHAIRMAN: 591 is a document filed on
12 behalf of Energy Probe, entitled "A" Stations Versus
13 "B" Stations and Darlington Performance Comparison.

14 And 592 is a Hydro document? Is that a
15 reserve document, Ms. Harvie? I think you reserved a
16 number; is that correct?

17 MS. HARVIE: I'm afraid I don't know.

18 THE CHAIRMAN: You don't know. All
19 right. Well, my understanding is that in order to keep
20 your -- you are printing up a number of this and you
21 are putting the number 592 on it so you have asked it
22 to be reserved, and it will be reserved.

23 So the next exhibit number will be 593
24 when we get to it.

25 MS. HARVIE: I will check over the break,

1 Mr. Chairman, about the proper title of 592.

2 THE CHAIRMAN: Thank you.

3 MR. D. POCH: Mr. Chairman, I would like
4 to fill slot 593, if I may.

5 THE CHAIRMAN: All right.

6 ---EXHIBIT NO. 591: Document, "A" Stations Versus "B"
7 Stations and Darlington
Performance Comparison.

8 ---EXHIBIT NO. 592: Reserved.

9 ---EXHIBIT NO. 593: Nuclear Cost Escalation.

10 MR. D. POCH: Following a frustrating
11 hour yesterday afternoon finding out that numbers had
12 interest in them and so on, we went back and produced a
13 summation of numbers based entirely on sets of data
14 that Hydro has provided and that in our materials that
15 I will take the witnesses to.

16 THE CHAIRMAN: Are we ready to proceed?

17 MR. D. POCH: Yes, Mr. Chairman. Perhaps
18 we can make this an exhibit for reference?

19 THE CHAIRMAN: It has been made 593.

20 MR. D. POCH: I'm sorry. I have done
21 that more than once.

22 DAVID WHILLANS,
23 KURT JOHANSEN,
24 FRANK CALVIN KING,
WILLIAM JOHN PENN,
25 IAN NICHOL DALY; Resumed.

1 CROSS-EXAMINATION BY MR. D. POCH (Cont'd):

2 Q. Mr. Penn, you indicated that we
3 shouldn't the '91 --

4 THE CHAIRMAN: Excuse me, Mr. Poch.
5 Could you just refresh my memory? Is this about the
6 table that had the first ones okay and Darlington was
7 out of line?

8 MR. D. POCH: That's correct, Mr.
9 Chairman.

10 THE CHAIRMAN: Where is that located?

11 MR. D. POCH: That appears at page 60 of
12 our first volume of materials, Exhibit 577.

13 THE CHAIRMAN: And that's Exhibit 589?

14 MR. D. POCH: That's correct, Mr.
15 Chairman.

16 Q. Mr. Penn, you objected to the use of
17 the Darlington numbers from the 1991 business plan for
18 the reasons you indicated, and did I understand
19 correctly, you felt that the appropriate way to do this
20 was with dry costs, constant dollars per kilowatt,
21 including constant interest rate, and you chose four
22 per cent as an equalizing figure. That is the one you
23 offered; correct?

24 MR. PENN: A. Four per cent real
25 interest rate is the interest rate that the EUCG

1 numbers contain.

2 Q. All right.

3 A. And that is what is in Pickering "A",
4 Bruce "A", Pickering "B" and Bruce "B".

5 Q. Could you turn to page 61 of our
6 exhibit?

7 A. Yes.

8 Q. And do you see there -- this is from
9 Interrogatory 8.2.14.

10 A. Yes.

11 Q. And these are Hydro numbers, and I
12 have taken the dry costs, second line from the bottom,
13 dry costs, constant dollars per kilowatt -- these are
14 December 31st, 1990 constant dollars -- and the note
15 indicates that these include interest at 4 per cent but
16 exclude all fuel and heavy water costs and energy
17 credit. Do you see that?

18 A. Yes, I can.

19 Q. If we look in Exhibit 593 we have
20 simply, again the same process, averaged the "A"
21 station, simple average, averaged the "B" stations,
22 included the Darlington number, and then worked out the
23 percentage changes.

24 I take it you are comfortable with this
25 calculation; whether or not you accept its

1 significance, the numbers are satisfactory to you?

2 A. Well, I haven't had time to study
3 them yet, but they are now consistent with the
4 Interrogatory 8.2.14 as far as I can tell, so that the
5 Darlington costs that you have in dollars per kilowatt
6 are those associated with the estimate of total cost of
7 \$13-1/2 billion.

8 Q. All right. And, in fact, it is a
9 little higher now? It is 13.8 billion now?

10 A. Yes, we are.

11 Q. So these percentages would slightly
12 understate the changes actually experienced thus far?

13 A. Yes, they would. The commentary made
14 yesterday, and I would like to make it again, is that
15 because of differences between stations for different
16 circumstances I don't think it is very appropriate to
17 average the "A" stations and average the "B" stations.

18 I gave a particularly good example
19 yesterday of Pickering "B" that had a planned delay of
20 one year for lower growth rate and had a two-year
21 additional delay because the manufacturer of the steam
22 generators used an incorrect stress relieving process
23 and the boilers had to be completely refurbished.

24 Q. All right. So that would of course
25 have tended to increase Pickering "A's" costs, the

1 example you just gave?

2 A. Pickering "B's" costs.

3 Q. Pickering "B's" costs, I'm sorry?

4 A. Yes, it did.

5 Q. But for that the spread between "B"
6 and Darlington would be even larger?

7 A. If you looked at it that way, yes.

8 Q. Of course, you experienced similar
9 problems at Darlington?

10 A. We --

11 Q. Different problems, but the same --

12 A. We have talked about the planned
13 delays, yes.

14 Q. Yes. All right. Well, if we want to
15 exclude interest the figures in the bottom half of the
16 page were taken from numbers you provided in 9.7.102,
17 which appears starting at page 70 of our materials and
18 the figures were from --

19 THE CHAIRMAN: Just a moment, please. I
20 don't know whether these have all been mentioned
21 before. 8.2.14 was the first one. Was it mentioned
22 before?

23 DR. CONNELL: Yes, it is 82.

24 THE CHAIRMAN: 82? Right. Thank you.

25 THE REGISTRAR: 8.2.14, that was

1 previously filed.

2 THE CHAIRMAN: 82.

3 THE REGISTRAR: Yes.

4 THE CHAIRMAN: What about 9.7.102?

5 THE REGISTRAR: This is now .85.

6 THE CHAIRMAN: Thank you.

7 ---EXHIBIT NO. 520.85: Interrogatory No. 9.7.102.

8 MR. D. POCH: Thank you, Mr. Lucas.

9 Q. And I was searching --

10 MR. PENN: A. Excuse me, I have got lost
11 with these numbers. What is .85, please?

12 THE CHAIRMAN: 9.7.102, the one just
13 mentioned.

14 MR. PENN: Oh. Thank you, sir.

15 MR. D. POCH: Q. I take it a large part
16 of the costs, extra costs associated with delays is in
17 the accumulating interest, the carrying charges? Not
18 all of the costs, as you have indicated.

19 MR. PENN: A. Are we talking about
20 Darlington, Mr. Poch?

21 Q. We are talking about any of your
22 facilities. When you have a delay the interest charges
23 would tend to be the share of that cost of that delay?

24 A. That is quite correct, but the reason
25 I asked you the question was that in the latter stages

1 of Bruce "B", and here is another example of why it is
2 difficult to get a clear comparison of these costs from
3 "A" to "B" station to Darlington.

4 Towards the end of the campaign in
5 building Bruce "B" and in about 1981 for Darlington
6 there was a financial policy change in the corporation
7 which meant that whereas previously the common services
8 associated with the whole plant was depreciated when
9 the first unit was placed in-service, so that typically
10 we depreciated about 43 per cent of the capital cost at
11 that time on the first unit in-service and subsequently
12 about 20 per cent in each of the remaining three, what
13 this change in financial policy meant was that the
14 capital was depreciated more evenly over all four
15 units.

16 The net result of that in Darlington was
17 a significant increase in the cost, and again it is all
18 interest.

19 But what I am referring to is on Exhibit
20 539 and appendix 5.1, and that amount of money on
21 Darlington amounted to 1.2 billion, and there was a
22 similar, much smaller amount on the Bruce "B" station
23 for the same reason.

24 Q. Mr. Penn, so I understand correctly,
25 the change in financial policy results in a lesser rate

1 increase for the first units coming into service; it
2 spreads the costs more evenly between the units, as it
3 were, for rate purposes? That is the motivation, if
4 you will, for this, is in terms of the sharing of costs
5 between different generations of customers?

6 [10:15 a.m.]

7 A. It was considered more equitable for
8 future customers and of course it also affected the
9 borrowing in the province.

10 Q. Now, we took the numbers that you
11 provided, I was searching for an understanding of to
12 what extent this interest was factor and you will see
13 that from the numbers you have provided that include 4
14 per cent interest, the "B" stations to Darlington
15 change was 45 per cent.

16 From Exhibit 102 I took the two lines
17 concerning comparisons between Bruce stations and
18 Darlington and they are not average but the two of them
19 appear separately and we have reproduced them at the
20 bottom half of page 593, you see those number as 89 and
21 61 per cent. Those numbers come straight off your
22 sheets.

23 A. Yes, I can see them.

24 Q. So the average would be if we exclude
25 interest again, this is constant dollar analysis, there

1 is a 75 per cent, roughly 75 per cent average -- I'm
2 sorry, 70 per cent. Have I got that right?

3 A. I'm sorry, are you asking me a
4 question?

5 Q. The figures are 89 and 61, a
6 significantly higher change if we exclude interest.

7 A. That's what this sheet paper says. I
8 would have to check these numbers.

9 Q. You can check them right now, Mr.
10 Penn, at page 72 and 73 of our material. The bottom
11 line on page 72 is Bruce "B" to Darlington, 61 overall
12 cost change percentage. If you look at the note it
13 says interest is excluded.

14 A. That's table 2, I have that, yes.

15 Q. Table 1 is where 61 comes from and
16 the bottom line of table 2 is where the 89 comes from.

17 A. Thank you.

18 I note that it is about 2 per cent per
19 year. That's another way of expressing this.

20 Q. I saw that the Bruce "B" to
21 Darlington, it's reported there as 8.4 and the Bruce
22 "A" to Darlington is 4.8.

23 THE CHAIRMAN: I'm sorry, just so I am
24 clear, are these tables, in the interrogatory, are
25 these constructions from information in the

1 interrogatory?

2 MR. D. POCH: These are provided by
3 Ontario Hydro as part of Interrogatory 9.7.102.

4 THE CHAIRMAN: So they are Hydro tables?

5 MR. D. POCH: Yes, they are Hydro tables.

6 THE CHAIRMAN: Taking Hydro's
7 information?

8 MR. PENN: Yes, they are Hydro tables.

9 My comment about 2 per cent per year, is
10 if you take the whole period of time from the "A"
11 stations to Darlington. In real terms, if interest is
12 excluded, the real cost increase on average per year
13 for Hydro's nuclear stations has been about 2 per cent
14 per year.

15 MR. D. POCH: Q. I wanted to look at how
16 you collapse numbers to constant dollars.

17 Could you turn back to page 71. This is
18 page 1 of the answer to 9.7.102 and there it says in
19 the second paragraph, table 1 shows changes in overall
20 annual basis.

21 The Ontario Hydro nuclear plant
22 escalation index was used for calculating
23 the cost changes in constant dollars.

24 The index is based on the Statistics
25 Canada Indices applicable to various

1 components of a composite basket of
2 material and labour items included in
3 nuclear plant capital cost.

4 You would agree with me that's the number
5 that you used to bring these figures to constant
6 dollars?

7 MR. PENN: A. That's the process used,
8 yes.

9 Q. Is it your understanding that you
10 would have used the nuclear escalation indices as well
11 when you produced the figures which appear at page 61
12 of our Exhibit in 8.2.14?

13 A. We would have used for the year
14 1989 -- I'm sorry, probably year 1990 we would have
15 used the nuclear plant escalation indices available in
16 the corporation in that year.

17 Q. How does this nuclear construction
18 deflator differ from the GDP deflator?

19 A. Well, I think somewhere amongst my
20 papers I have such a comparison.

21 Q. Well, I actually have one in
22 numerical terms. I was thinking more in terms of --

23 A. Not being an economist I can't tell
24 you how the nuclear plant escalation indices are
25 specifically derived. I know that over the last number

1 of years it's been higher than the CPI rate of
2 increase. But I can't help you any further.

3 Q. So since it was a steeper
4 escalation --

5 A. It's not a steeper escalation. It is
6 just more or less parallel, but the nuclear plant
7 escalation index is higher.

8 Q. It's higher.

9 A. They are parallel more or less. The
10 rate of slope is about the same.

11 Q. Perhaps we should look at that then.

12 At page 68 of our exhibit we have taken
13 the two and put them side by side. In fact, first of
14 all I should point to you page 67 was where you have
15 provided nuclear construction cost indices, the top
16 line there. Do you see that?

17 A. Yes, do I. I had a bit of difficulty
18 personally, I would have to consult with our economist
19 but I wasn't clear that these two sets of numbers could
20 be directly compared, because the 100 index occurs in
21 different years, and I am just not knowledgeable enough
22 to know whether these two sets of figures are strictly
23 comparable or not.

24 Q. Mr. Penn, we will have to do this
25 then subject to your later confirmation, but we have

1 simply, on page 68, done the average changes for
2 different periods, for the two deflators, and you can
3 see there that the nuclear index is a somewhat steeper
4 index than the GDP deflator.

5 A. Well, that's what these numbers,
6 show, yes.

7 Q. And it's the nuclear index that you
8 used to move your different stations to common dollar
9 figures?

10 A. Yes.

11 Q. Would you agree if you used a lower
12 index, for example, the GDP index, the spread between
13 earlier and later stations would be even greater?

14 A. Well, the gross domestic product
15 index is smaller. Given that your numbers are right
16 and that the rate of change of these two indices
17 diverge with time, which is what your numbers show,
18 then I think you are probably right--

19 Q. And so in effect --

20 A. --but - if I may just finalize that
21 thought - we use the nuclear plant indices because it
22 incorporates labour rates and overheads and all the
23 other social issues that we enjoy in this society. So
24 that's why we use them. It's more appropriate than the
25 CPI.

1 Q. Mr. Penn, I am not disagreeing that
2 it's inappropriate to use a nuclear escalator if you
3 want to see where costs will be a year from now or two
4 years from now. What I am suggesting to you, though,
5 is if we are comparing these difference generations of
6 plants and we want to see what the escalation in your
7 cost has been specific to nuclear, to use a deflator,
8 which in effect backs out some of the escalation that's
9 special to nuclear, it tends to diminish the value of
10 comparison.

11 A. I am sorry, I don't follow your line.
12 I just don't have the knowledge to comment on that.

13 THE CHAIRMAN: That may be a Panel 10
14 kind of question anyway.

15 MR. D. POCH: I understand of course that
16 Mr. Snelson is someone that is familiar with these
17 terms and perhaps that would be appropriate place to
18 revisit this, Mr. Chairman.

19 Q. Mr. Penn, just so we understand the
20 difference here. On page 68 when we look at the
21 average change over the 20-year period -- rather 18
22 year period, '71 to '89, for the two indices, the
23 average, or the average annual change for the nuclear
24 is almost 1 percentage point higher than for the GDP.
25 You see that, .9 per cent.

1 [10:25 a.m.]

2 MR. PENN: A. Well, that's what these
3 numbers show.

4 Q. All right. And you would agree with
5 me that, for example, if we refer to the effect of a 1
6 per cent change in the long-term load forecast over 20
7 years this is a very significant effect when you
8 compound it? A 1 per cent change in escalation is a
9 significant change?

10 A. I am afraid I am not in a position to
11 discuss this subject. I thought we had a panel that
12 discussed load growth and economic growth and the like.

13 MR. D. POCH: All right. Perhaps so that
14 we don't have to spend much time on Panel 10 on this,
15 Mr. Chairman, I might ask for a transcript undertaking
16 that Hydro would confirm these deflator, this deflator
17 comparison or provide one that they are comfortable
18 with.

19 THE CHAIRMAN: You mean confirm the
20 mathematics or the philosophy behind it?

21 MR. D. POCH: Well, given my experience
22 of getting little surprises, I am trying to avoid any
23 waste of time on Panel 10, and I don't want to present
24 this to Mr. Snelson on Panel 10 and have him say, oh,
25 well, you have used the one we used for capital but not

1 for production, or what have you. I would like to be
2 sure that the nuclear index presented there is indeed
3 the one that Hydro would have used in, for example,
4 9.7.102, and if not --

5 THE CHAIRMAN: If the givens are in
6 accordance.

7 MR. D. POCH: And if not, if they would
8 provide the appropriate index.

9 THE CHAIRMAN: That is okay, is it, Ms.
10 Harvie?

11 MS. HARVIE: Yes, it is.

12 THE REGISTRAR: 532.6.

13 ---UNDERTAKING NO. 532.6: Ontario Hydro undertakes to
14 confirm the deflator comparison in
Exhibit 577 at page 68.

15 MR. D. POCH: Thank you.

16 MR. PENN: I would like to add a point,
17 Mr. Poch.

18 I stated before that Interrogatory 8.2.14
19 is a very comprehensive document and it compares for
20 the whole of Hydro's nuclear program right since 1971
21 to today the rate of change in constant dollars, in
22 dollars per kilowatt, for all our stations.

23 And there are graphs in that
24 interrogatory, and if I may, Mr. Chairman, I happen to
25 have a transparency from that particular document that

1 would perhaps help you and the other Panel members to
2 understand these rates of change that Mr. Poch has been
3 trying to explore with us.

4 MR. D. POCH: Q. Well, Mr. Penn, can you
5 just confirm for me that the number that I provided and
6 I used in the exhibit just filed, which appears on page
7 61 of our material, is indeed the numbers you have
8 produced in that exhibit?

9 MR. PENN: A. I can assure you that they
10 are the numbers that are in this exhibit.

11 Q. All right. Well, that's fine, then.

12 A. But I think this graph, if you could
13 show it for me...?

14 MS. HARVIE: Mr. Chairman, if I may just
15 point something out at this point.

16 Although Mr. Poch has only filed one page
17 from Interrogatory 8.2.14, it is our understanding that
18 the entire interrogatory is filed as an exhibit. It
19 is, as Mr. Penn has indicated, a document consisting of
20 some 20 pages, and I just want to confirm that that
21 entire thing is the exhibit and not simply this one
22 page.

23 THE CHAIRMAN: That is the understanding.
24 If an interrogatory is referred to it is the entire
25 interrogatory, and also the same is true of a document.

1 It is a very desirable practice to do exactly what CEG
2 has done; that is, to put in only the pages that they
3 intend to refer to. But implicit in that is that if
4 any party needs the whole document that that will be
5 made available. But the bulk of having to--

6 MS. HARVIE: Yes.

7 THE CHAIRMAN: --put 577 and 578 together
8 with everything in it would probably be almost unwieldy
9 and so on.

10 MS. HARVIE: No, I understand, but I
11 would want it to be understood that you have available
12 to you the entire interrogatory and you won't be
13 prevented from looking at it in its entirety if you
14 felt necessary.

15 THE CHAIRMAN: No, no. Once an
16 interrogatory is on the table then it is part of the...
17 And can be used by any party as they see fit from then
18 on.

19 MS. HARVIE: Thank you.

20 THE CHAIRMAN: I take it that what is now
21 on the screen is something from that interrogatory; is
22 that correct?

23 MR. PENN: It is from Interrogatory
24 8.2.14.

25 THE CHAIRMAN: Yes.

1 MR. PENN: There doesn't seem to be a
2 page number, I'm afraid, but it is --

3 THE CHAIRMAN: It is entitled the EUCG
4 Data: Nuclear Plants.

5 MR. PENN: Yes.

6 THE CHAIRMAN: Total dry costs in 1991
7 Canadian dollars per kilowatt?

8 MR. PENN: Yes. And what this is it is
9 an update of this information with the latest
10 Darlington costs.

11 THE CHAIRMAN: All right.

12 MR. PENN: And what it shows in constant
13 dollars Canadian, in December, 1991 dollars - so it is
14 very current - is the total dry costs, including four
15 per cent real interest, so that it includes the
16 interest, not excludes it.

17 And it shows, moving from the midpoint of
18 the unit in-service for the four units of Pickering
19 "A", that is roundabout 1972/73, shows that Bruce "A"
20 in constant dollars is slightly less than Pickering
21 "A", it shows Pickering "B" as slightly more because of
22 the reasons I mentioned before, it shows considerable
23 improvement in Bruce "B" relative to Pickering "B", and
24 it shows Darlington currently with a midpoint of
25 in-service of all four units of about 1993.

1 The other points on this graph for
2 interest are plants in the United States which are
3 either one-unit, two-unit or three-unit in size. Of
4 course, Hydro's are all four units in size.

5 I just wanted to show you this to
6 pictorially place in front of you the fact that when I
7 said that there was about 2 per cent real increase per
8 year over that period of time that you could get that
9 perspective.

10 MR. D. POCH: Q. Mr. Penn, perhaps we
11 could just leave that up for a moment.

12 Could I ask you, I take it from this that
13 we can see that the rate of cost escalation in other
14 countries has been more serious between different
15 generations of plants, that you have been able to
16 control it much more effectively than some of your
17 colleagues abroad?

18 MR. PENN: A. Well, what it shows is in
19 the period from about early 70s - 1971 is the first
20 point, thereabouts, to about 1984 - that costs in the
21 United States and costs in Canada were relatively
22 similar, although the scale of course on the vertical
23 axis is a small scale.

24 And then it shows the effect of
25 regulatory issues in the United States and delays to

1 plants such as Shoreham, for example, and the impact on
2 the capital costs in the United States.

3 Q. And you would agree with my
4 observation that for whatever reasons you have been
5 much more successful at controlling costs changes
6 between generations of stations than your colleagues in
7 the States; is that fair?

8 A. You could put it that way.

9 Q. So despite your highly successful
10 efforts in this regard you would agree that the figures
11 we have produced in Exhibit 593 show that there is
12 still a considerable increase between these stations?

13 A. Well, the increase on average, as I
14 have stated, is about 2 per cent per annum.

15 Q. Right.

16 A. And we discussed several days
17 previously the reasons for these increases.

18 Q. All right. Now, Mr. Penn, I think we
19 agreed, the day before yesterday I guess it would have
20 been, that you are not comfortable modelling what you
21 have termed, I think, externally initiated delays like
22 those precipitated, as Mr. McCredie shows in his
23 exhibit --

24 A. Well, the reason is that I --

25 THE CHAIRMAN: Just wait until he

1 finishes his question, please, Mr. Penn.

2 MR. PENN: Sorry.

3 MR. D. POCH: Q. Like those precipitated
4 by changes in the load forecast or the capital
5 borrowing constraint or the strikes or what some have
6 called collectively political interventions, and first
7 of all, do I understand it correctly, you have no basis
8 is what you are telling us to model these as a trend
9 that we could expect in the future?

10 MR. PENN: A. That is quite correct. I
11 have no basis for the magnitude of potential delays of
12 that nature so that we would have to define scenarios
13 so that comparisons of all options would be equally
14 treated.

15 Q. Yes. And thus, the only place you
16 could capture the possibility that this might occur is
17 in your 15 per cent contingency?

18 A. No, the 15 per cent contingency,
19 which is for proven CANDU options if you recall, are
20 based upon a knowledge of a data base of the
21 uncertainties, for example, in the material costs, in
22 the equipment costs, in construction indirects and
23 construction directs, and engineering hours and the
24 like, which Hydro has control over and has a long
25 historical basis for.

1 Q. All right. So the 15 per cent, then,
2 includes nothing for these types of uncertainties?

3 A. No, it doesn't.

4 Q. All right. And I take it, then, if
5 we wanted to try to incorporate these kinds of
6 uncertainties that would be properly sort of a planning
7 uncertainty question. We can deal with that in Panel
8 10. It is not something that you would view as part of
9 your nuclear costing exercise?

10 A. That's quite correct.

11 Q. Okay. Now, I did want to deal with
12 another aspect that will be related to planning, and
13 that is unreliability in in-service date projections.

14 First of all, let's turn to page 79 of
15 our materials.

16 A. This is in--

17 Q. The first volume.

18 A. --Exhibit 577?

19 Q. That is correct. There and in the
20 following pages you were kind enough to provide us with
21 the printout of a speech delivered by Mr. Don Anderson,
22 Vice-President, Design and Construction, Ontario Hydro,
23 to the Canadian Nuclear Society, October 29th, '91.

24 Perhaps that could be made an exhibit?

25 THE CHAIRMAN: Number?

1 THE REGISTRAR: 594.

2 ---EXHIBIT NO. 594: Printout of speech delivered by
3 Mr. Don Anderson, Vice-President, Design
4 and Construction, Ontario Hydro, to the
Canadian Nuclear Society, October 29th,
1991.

5 MR. D. POCH: Q. If you could turn to
6 page 98 and 99 of our exhibit, pages 18 and 19 of the
7 text of that speech, Mr. Anderson said at the bottom of
8 page 18:

9 In the meantime, there is still a
10 black cloud hanging over Ontario Hydro's
11 nuclear program and the entire industry.
12 The cloud is Darlington. I find it
13 disheartening at times that we could
14 spend over \$12 billion to build a nuclear
15 plant of the highest quality with the
16 most advanced technology and discover it
17 has a strange and even mysterious flaw.
18 Darlington is it like a superbly muscled,
19 finely tuned athlete with a heart defect.

20 Can I take it from that, the experience
21 recounted there, that one risk of such complex
22 megaprojects is potential delay in initial
23 availability?

24 MR. PENN: A. There is always a
25 potential for a delay. Of course, there is always

1 potential for advance as well.

2 Q. Well, we have already talked about
3 whether that is a symmetrical likelihood. I think you
4 agreed it was not symmetrical, the likelihood.

5 [10:40 a.m.]

6 A. I think we were talking about costs
7 at the time. We haven't yet explored this issue.

8 Q. Can we talk about delays. Would you
9 agree it's not a symmetrical likelihood there either?

10 A. Well, I can cite the fact that
11 Pickering "A" was built on schedule. I clearly
12 remember because we took a great deal of pride in it,
13 that we actually brought in-service Units 3 and 4
14 literally 19 and 23 days after criticality. And in
15 fact, Mr. Daly has just handed me some numbers out of
16 Exhibit 43.

17 Q. Rather than take us through all the
18 individual data points, I am interested in your overall
19 judgment. Do you think that the likelihood of delay
20 in-service, there is a greater likelihood of delay than
21 advanced on a future station?

22 A. I think that the major large
23 engineering projects and the people responsible for
24 them throughout the world have recognized that if you
25 don't fully engineer a project before you start

1 building it; in other words, you have only got a small
2 amount of your engineering done and you are trying to
3 construct the plant at one and the same time, then
4 there is very significant risk of delay of schedule.

5 The thing that motivated us to launch the
6 scheduled cost reduction program, which actually was a
7 forerunner of one in the United States, we sort of led
8 the way there, was just to address that issue. How
9 could you provide confidence in the decision-maker's
10 mind that when you said you are going to have a plant
11 in-service by such-and-such a year it would be.

12 Major groups throughout the world, the
13 United States, France, and Japan, and I visited these
14 country and talked about this subject at great length,
15 have all adopted approaches to minimize schedule
16 delays, because it hits, as we have been discussing,
17 interest very hard if there is delays.

18 Q. Indeed in a planning context there
19 would be no energy from this facility at the time when
20 it may be needed and there could be either penalties in
21 the sense that you would have to turn to other more
22 expensive fuels available at that time; is that fair?

23 A. Well, it is a potential. But you as
24 I am sure Mr. Snelson will have told you or certainly
25 will in the next panel, that utilities don't plan like

1 the automobile industry on the just-on-time or
2 just-in-time basis in supplying energy to a province
3 like this.

4 So, I think your comment is a little
5 hypothetical.

6 Q. Okay. Let's just examine your
7 comments.

8 If we look at the delays we saw with
9 Darlington, I think they are most easily seen in
10 Exhibit 539, the letter from Mr. McCredie, in appendix
11 2 of that letter, scheduled changes in months. Despite
12 perhaps the finest of engineering efforts on your
13 behalf, I am sure you would agree, would you not, that
14 there is a little an engineer can do about the
15 possibility of a strike, or a constraint due to capital
16 availability in the marketplace, or load growth change
17 which dictate changes in the schedule?

18 A. Well, I think these are planning
19 matters.

20 I would be surprised, I don't think
21 people would admit that you can't do anything about a
22 potential strike. I don't think anyone would assume
23 that given borrowings all over the world, that you
24 might not be able to borrow money. You will always
25 able to borrow money at a price.

1 Q. At a price.

2 A. Load forecast, that's a different
3 matter.

4 Q. But you would agree that the delays
5 we have seen for things like lower load forecast or
6 capital constraints, these weren't arbitrary; these
7 were motivated by cost reduction. If the borrowing had
8 continued at that rate, the province's cost of
9 borrowing would have gone up, and there was a judgment
10 made somewhere - not in the engineering department of
11 Hydro but somewhere - that it was more cost-effective,
12 it made more sense to slow down and similarly with the
13 load forecast.

14 A. I am afraid I don't know what the
15 considerations were with regard to borrowing. As you
16 know, Hydro is a major borrower in this province and no
17 doubt we don't want to Hydro and the provincial
18 government competing for limited funds, I don't know if
19 that's a possibility.

20 Q. If we just skim down the list
21 further, items such as item F, recognition of more
22 complex engineering and construction workload; G, late
23 turnover of more complex systems, these then were more
24 the kinds of errors, if you will, that you are trying
25 to avoid in the future?

1 A. Yes, I would agree with that.

2 I would note that recognition of more
3 complex engineering construction workload only amounted
4 to four months, not that I want to belittle four
5 months, on one unit. Certainly recognition of late
6 turnovers of more complex systems to operations, and of
7 course there was the added comment that you didn't read
8 where we had a limited number of trained operators at
9 that time. The first part that is undoubtedly due to
10 the fact that insufficient engineering was done to
11 allow construction to proceed at the highest
12 productivity level to avoid mistakes, to avoid rework,
13 and the consequence of all this is that these certain
14 systems were handed over from construction to
15 operations later than was expected.

16 Q. All right. Could we turn to page 112
17 of materials we have provided. This is in 577 and page
18 122, and it's interrogatory 9.7.285.

19 THE REGISTRAR: .86.

20 ---EXHIBIT NO. 520.86: Interrogatory No. 9.7.285.

21 MR. D. POCH: Q. And there you have
22 indicated in the second paragraph the in-service delay
23 for Unit 1 for a single unit at Darlington is about .9
24 million and the replacement energy cost is
25 approximately .3 million, and you have expressed it as

1 per unit, and those are daily figures; correct?

2 MR. PENN: A. Yes, it's quite right,
3 that at this stage of completion of Unit 1, which is
4 about 99 per cent, I believe, that the interest on that
5 unit amounts to \$900,000 a day.

6 The energy replacement figure of course
7 of .3 million per unit per day is a cost of when we
8 would need to replace the energy of course, for
9 example, in the peak winter period. We would not incur
10 that cost every day of the year because we wouldn't
11 need the power.

12 Q. As it's turned out simply because
13 load has fallen compared to originally predicted.

14 A. Well that and the seasonal changes.

15 Q. In fact, we have already heard that
16 in most years Hydro burns coal throughout most of the
17 year, and I take it that's based on coal replacement
18 costs?

19 A. Could you repeat that, please?

20 Q. I take this that figure is based on
21 coal replacement costs?

22 A. Again, I'm not responsible for
23 purchasing power, but I would think it's a mix. We buy
24 power from Quebec and Manitoba, which is hydroelectric
25 of course, and we do buy power from Pennsylvania and

1 Ohio and Michigan that's coal-fired.

2 Q. Now, Mr. Penn, these kind of
3 penalties, if you will, the fuel cost penalty is not
4 dependent upon when a delay arose in the schedule, I
5 take it, as long as there is a delay at the end point
6 that penalty is going to be faced assuming you have to
7 turn to other fuels?

8 A. If I understand your question, I
9 don't think the replacement energy cost relies upon
10 when there is a delay in the project, if that's what
11 you are asking.

12 Q. And the interest penalty does to some
13 extent because if it's at the end then you are carrying
14 the full load of capital.

15 A. That's quite right.

16 Q. And if it's in the middle presumably
17 you will have sunk some lesser fraction, so the
18 interest during that time that you are carrying would
19 be on a lesser amount of capital?

20 A. Well, of course it depends on the
21 profile of the cash flow. And certainly the plans for
22 the future stations as I mentioned were to have
23 advanced engineering or what we call pre-engineering
24 and pre-procurement of major equipment, and that shifts
25 the profile of the spending. So it depends on the

1 profile of spending.

2 Q. Yes. But, of course, if you do incur
3 an interest carrying charge earlier on in a project's
4 life, the money you borrow to carry that interest in
5 turn is capitalized and you still have to carry that
6 and it compounds out to the end date, too, doesn't it?

7 A. Yes.

8 Q. I had actually calculated it based on
9 60 months, which was the earlier number in the
10 interrogatory that Mr. McCredie has updated here, it's
11 actually more than that now, but if we took the 60
12 months of delays for four units and multiplied out this
13 \$1.2 million, which I note, by the way, also appears at
14 the bottom of Exhibit 9.7.286--

15 THE REGISTRAR: That is .87.

16 ---EXHIBIT NO. 520.87: Interrogatory No. 9.7.286.

17 MR. D. POCH: Q. --which is on page 113.

18 And we multiply by -- well, 60 months is
19 five years, times 365 days per year, that gets us close
20 to \$9 billion.

21 MR. PENN: A. Well, first of all let me
22 say that I have just commented on the fact that we only
23 buy energy when we need it. We don't buy .53 million
24 per day every day.

25 Q. Yes.

1 A. So, I don't think you can take the
2 full 1.2.

3 Q. All right.

4 A. And I will have to check your
5 arithmetic. I didn't have a chance to write down the
6 numbers.

7 Q. I just multiplied 1.2 million times
8 four units times five years, so it's 1.2 times 20,
9 which happens to be 24, times the number of days in a
10 year, and that of course is the same number as hours in
11 the year, which is 8,760, it was real easy math for us,
12 so \$8,760 million

13 A. Well, at the present moment, Mr.
14 Poch, we have only declared one unit in-service, and of
15 course that's Unit 2, which is the first unit to be --
16 of any nuclear power station, it's always Unit 2 that
17 is declared in-service first.

18 We don't have four units in-service. So,
19 there is another reason you can't multiply by 1.2.

20 Q. Well, the delays are expressed by Mr.
21 McCredie for each of the units, we can assured that
22 these are the minimum delays that we will face for
23 those units, and from what you have just told me in
24 fact, my numbers underestimate then, you are pointing
25 that out, because some of these units may be delayed

1 even further.

2 A. I think your little sum is
3 hypothetical. It sort of says, well, if when we had
4 committed Darlington we would have needed the power for
5 the in-service that was five or six years, I think you
6 said 60 months, didn't you--

7 Q. Yes?

8 A. --earlier, then yes, maybe the cost
9 to the customer would have been that large sum. But
10 reality has been that we haven't needed the power.

11 Q. Yes. But, Mr. Penn, if we are
12 looking forward at a future station, which you would
13 presumably commit to because you believe that we do
14 need the power, if that forecast is right but you
15 experience delays, then that is the kind of cost we
16 would face; correct?

17 A. Well, again, I mentioned earlier that
18 Ontario Hydro is a prudent planner and again this is a
19 subject that Mr. Snelson is particularly expert in.
20 And I am sure that Mr. Taborek in earlier panels, I
21 imagine Panel 3, has talked about our reserve and the
22 importance of it and the margins in reserve.

23 Q. Yes, all right. Now, Mr. Penn,
24 cognizant as we were of your concern that some of the
25 delays were, I think I can use the colloquial term, not

1 your fault, you being the engineering group, but
2 were --

3 [10:55 a.m.]

4 A. Oh, as a member of Ontario Hydro, I
5 take it, I have responsibility. I don't pass blame.

6 Q. All right. There was a distinction
7 drawn at least in Mr. McCredie's paper between what he
8 called planned schedule changes due to these external
9 factors such as load forecast that we have spoken of--

10 A. Yes, because they weren't under his
11 control.

12 Q. Right. --and schedule slippage.

13 So if you turn back to page 111 all we
14 have done there is seen what portion of this roughly \$9
15 billion figure I spoke of a few minutes ago was due to
16 recent slippage, and, in other words, since we chose as
17 a starting point 1988 since the forecast dates you
18 provided to ONCI which are provided above there, and,
19 as you can see, it comes to about \$2-1/2 billion, do
20 you agree that that is about right?

21 This is just the interest and replacement
22 power; this is not the other cost increases you have
23 spoken about.

24 THE CHAIRMAN: Let me just catch up with
25 you. This is a document that has been produced by your

1 client; is that right?

2 MR. D. POCH: Yes, it is, Mr. Chairman.

3 THE CHAIRMAN: And the source of the
4 information is from 539 and from ONCI; is that right?

5 MR. D. POCH: That's correct, Mr.
6 Chairman. And from 9.2.117A.

7 THE CHAIRMAN: Hold it. Just a minute.
8 9.2.117A?

9 MR. D. POCH: Yes. And I don't know if
10 that has number yet, Mr. Chairman.

11 THE REGISTRAR: That will be .88.

12 THE CHAIRMAN: All right.

13 ---EXHIBIT NO. 520.88: Interrogatory No. 9.2.117A.

14 THE CHAIRMAN: And from Exhibit 539?

15 MR. D. POCH: No, not from Exhibit 539,
16 Mr. Chairman.

17 THE CHAIRMAN: Oh, no?

18 MR. D. POCH: No. In fact --

19 THE CHAIRMAN: I thought the slippage
20 reference gave that. That was an attempt to break it
21 down.

22 MR. D. POCH: No, Mr. Chairman. All I am
23 suggesting here -- I had just been leading up to this,
24 drew Mr. Penn's attention to the fact that Mr. McCredie
25 drew some distinction for whatever reason between --

1 THE CHAIRMAN: This is the first time I
2 have -- according to Ontario Hydro is not a 539
3 derivation --

4 MR. D. POCH: According to Ontario Hydro
5 it refers to the cost figures there, the multipliers,
6 which were the \$.9 and \$.3 million per day reference.

7 THE CHAIRMAN: Oh, all right. All right.

8 MR. D. POCH: It is a simple
9 multiplication like I took Mr. Penn through a moment
10 ago for the total 60-plus months.

11 THE CHAIRMAN: And which he didn't agree
12 with -- that's the best that could be a maximum figure,
13 something less than that.

14 MR. D. POCH: Q. And your reason, Mr.
15 Penn, just to make this clear, was because of your
16 feeling that the .3 figure overstated the actual fuel
17 penalty because you wouldn't in fact have needed energy
18 throughout that period every day?

19 MR. PENN: A. Well, that's correct, and
20 I'm sure Ontario Hydro would be able to determine what
21 power purchases we made because of unavailability of
22 Darlington units.

23 Q. Well, Mr. Penn, certainly --

24 A. My point is that to do arithmetic
25 like this it certainly comes up with a large number,

1 but it is not reality.

2 Q. Mr. Penn, I took these numbers from
3 the numbers you gave us in the interrogatory. Let me
4 just ask you, the .3 million --

5 A. Oh, I don't have any problem with the
6 .9 mills per day and .3 mills per day purchase when we
7 need the power.

8 What I am commenting on is that you have
9 taken day's slippage, and we will have to come up with
10 how you derived that in a moment, and then you have
11 multiplied it by these numbers to come up with a total
12 cost of \$2-1/2 billion. And I am saying that is not
13 reality.

14 Q. Mr. Penn, let me ask you about that.
15 First of all, the .3 million isn't the cost of buying
16 power from abroad, is it. That is based on whatever
17 your alternative may be - burning more coal at your own
18 plants?

19 A. Yes, it could be that. It is
20 replacement power costs.

21 Q. Right. Indeed, if we look below here
22 at cost of replacement energy, according to Ontario
23 Hydro, we have tried to calculate out what that is. We
24 took your \$300,000 per day figure, we took the capacity
25 of Darlington and assumed 80 per cent, which we assumed

1 you would have been using, and figured out what the
2 daily energy generation would be. And so we were able
3 to determine what the \$300,000 per day is on a cents
4 per kilowatthour basis, and it is 1.77 cents.

5 Do you see that?

6 A. I am not doubting the arithmetic at
7 all or the methodology.

8 Q. All right.

9 A. What I am questioning is that, for
10 example, on a day like today I would be absolutely
11 amazed if the peak load was more than 18,000 megawatts,
12 and I think our system can supply it without worrying
13 about buying replacement energy. I am just trying to
14 say to you that that may be quoted as 300,000 daily,
15 but what it means is when we need to buy it.

16 Q. All right. And Mr. Penn, just to
17 make sure we are talking about the same thing, would
18 you turn to page 234 of our exhibit, where we have
19 reproduced a page from Exhibit 465, Thermal Cost
20 Update, 1991 dollars?

21 A. Could you give me the page again,
22 please?

23 Q. Second last page, 234. And can you
24 just look in the upper right-hand corner, one box down
25 and one box in, and you see the fuel cost for a 4 by

1 800 megawatt thermal option - this is just fuel - 1.77
2 cents?

3 A. Yes.

4 Q. All right. So I took from that --

5 A. But I notice this is from the Thermal
6 Cost Update.

7 Q. Yes.

8 A. Thermal Cost Review, I presume, we
9 talking about?

10 Q. Yes, the update to that review.

11 A. Fossil Cost Review we are talking
12 about. And in my knowledge of these numbers, these are
13 for in-service in 2002.

14 Q. Yes.

15 A. And so these levelized unit energy
16 costs are fueling costs are for the future. They are
17 not current costs.

18 Q. Yes. And to the extent that your
19 forecasted fuel price in the future is different, then
20 your current coal prices, there might be some
21 difference.

22 But, Mr. Penn, isn't it fair to assume
23 that the number is so close to the one that was used to
24 calculate the \$.3 million per day we can assume that .3
25 million dollars per day is close to just the fueling

1 costs of your coal stations?

2 MS. HARVIE: Mr. Chairman, I am quite
3 worried about this line of cross-examination.

4 The witness has said he is not sure what
5 the replacement energy is made up of. He admits that
6 it is made up by fossil fuel stations in part, and now
7 Mr. Poch is continuing to ask him questions on the
8 assumption that it is made up of fossil fuel, and these
9 are questions clearly that should be directed to Panel
10 10 witnesses who are planners.

11 MR. D. POCH: Mr. Chairman, I am happy to
12 pursue that with someone on Panel 10 who may understand
13 that.

14 Q. Mr. Penn, two points here. I think
15 it was the Canadian Nuclear Association who suggested
16 that if you committed to a nuclear plant and it was on
17 line before fully needed you could potentially export
18 the power surplus? Do you recall that?

19 MR. PENN: A. Well, I don't recall it,
20 and Ontario Hydro has a clear policy that it does not
21 build for export.

22 Q. I understand that. But that in a
23 situation, for example, had Darlington come on line and
24 had you not needed all the power presumably you could
25 have exported some power?

1 A. It would have been in the interest of
2 our customers to get the highest price we could for
3 that excess energy.

4 Q. Right. So whether or not you needed
5 the power domestically during the five years of delay
6 if we could have used it domestically and we had to
7 turn to more expensive fuels we paid that penalty, and
8 if we couldn't have used it and we would have exported
9 it we have lost the export profit; fair?

10 THE CHAIRMAN: Well, perhaps that is
11 again sort of a Panel 10 kind of question, isn't it?

12 MR. D. POCH: Q. Well, Mr. Penn, I don't
13 know. Are you comfortable answering that or not?

14 MR. PENN: A. Well, only in a general
15 sense, Mr. Poch. I think it is self-evident what you
16 are saying.

17 Q. All right. Thank you.

18 THE CHAIRMAN: I am wondering if page 111
19 of Exhibit 577 shouldn't be given a separate exhibit
20 number.

21 THE REGISTRAR: 595.

22 THE CHAIRMAN: Thank you.

23 ---EXHIBIT NO. 595: Page 111 of Exhibit 577.

24 MR. D. POCH: Mr. Chairman, I put words
25 in the mouth of CNA and Mr. Penn didn't recall it.

1 Just so that the record is clear, I took that from the
2 middle of page 22361 of the transcript.

3 DR. CONNELL: I would like to ask a
4 question about page 112 of Exhibit 577. This is
5 Interrogatory No. 9.7.285.

6 The reference in the second paragraph of
7 the response is to daily capitalized interest costs
8 associated with the Unit 1 in-service delay is about
9 \$0.9 million.

10 Does any member of the panel know whether
11 that is the current estimate as of the date of this
12 response or whether it is an average integrated over
13 the full delay period?

14 MR. PENN: I think I would have to check,
15 Dr. Connell, but I believe that is just a simple
16 derivation from the cumulative capital expenditure to
17 the start of the delay and is just the interest that we
18 have to pay because we haven't declared the unit
19 in-service.

20 DR. CONNELL: Well, I will assume then it
21 is the cumulative rate unless I hear otherwise.

22 MR. PENN: Yes. And, of course, we
23 capitalize that interest and then it is depreciated
24 with the capital once in-service occurs.

25 DR. CONNELL: Right.

1 MR. D. POCH: It may be helpful, Dr.
2 Connell, I just note included in 9.7.117A, which
3 appears at page 109 of our exhibit and it has been
4 given Exhibit No. 520.88, on the page of the answer
5 which is at 110 the completion percentage of Darlington
6 units is provided there.

7 DR. CONNELL: Thank you.

8 MR. D. POCH: Q. Now, again, this is all
9 slippage the numbers appearing on page 111 as opposed
10 to the larger \$9 billion figure, or somewhat less than
11 9 billion for the reasons you have indicated. This is
12 all recent slippage that there was control over, in
13 your words, by the project management people?

14 MR. PENN: A. Well, that slippage you
15 are referring to is in appendix 2, Exhibit 539, and in
16 the sense that the project has managerial
17 responsibility over everybody involved in building the
18 stations the answer is yes, it is in their control.

19 Q. All right. And, Mr. Penn, I note on
20 page 112 of our material in Exhibit 520.86 there is
21 mention that a ASEA Brown Boveri is not responsible for
22 consequential damages. Indeed, I recall that Dr.
23 Connell had asked you about that, for example, these
24 consequential damages of more expensive fuel burns or
25 lost export opportunities.

1 And you replied, if my memory serves me,
2 you wished you could get such a contract; it is not
3 just not the kind of contract one can ordinarily
4 obtain. Is that fair?

5 A. Well, I am not aware of any major
6 contract anywhere in the world where a utility could
7 get guarantee of consequential damage.

8 Q. I was intrigued by the comment
9 because I understand ASEA Brown Boveri now owns
10 Combustion Engineering?

11 A. Yes, it does.

12 Q. And Combustion Engineering is a
13 proponent of non-utility generation. You are aware
14 that that is part of their business and that they
15 offered to build at least?

16 A. Every electrical company, including
17 General Electric and Westinghouse, also have similar
18 programs.

19 Q. Would you agree that when they are
20 wearing that hat and they make a contract with Ontario
21 Hydro if they experience a delay they have to pay the
22 interest?

23 A. I'm sorry, I am not following your
24 question. You mean the manufacturers --

25 Q. When they are the capital investor as

1 a non-utility generator and if they run into delays for
2 whatever reason it is they who will be carrying their
3 borrowing cost; it is not Ontario Hydro.

4 A. Well, applies to every business.

5 Q. Yes. Okay.

6 THE CHAIRMAN: But that is the same
7 principle, isn't it?

8 MR. D. POCH: Yes.

9 Q. The point I am trying to make here,
10 Mr. Penn, is that in one scenario when ASEA Brown
11 Boveri makes a mistake you pay the interest penalty,
12 and in the other scenario where you let them be the
13 turbine manufacturer and the generator they pay the
14 interest penalty. It is the person who owns the
15 generating facilities that pays the interest penalty?

16 MR. PENN: A. I am afraid I will have to
17 think about that over the break.

18 Q. It is really again a planning risk
19 question.

20 Now, I recall that you showed us a slide
21 of Bruce Heavy Water Plant in your evidence in chief.
22 Do you recall that?

23 A. Yes, in my introductory.

24 Q. Yes.

25 A. I showed an aerial photograph of the

1 whole Bruce complex, and in the centre of it is the
2 heavy water plants, yes.

3 Q. How many Bruce heavy water plants
4 have been released over the years?

5 A. Well, two have been built.

6 Q. Yes?

7 A. That is Bruce Heavy Water Plant "A"
8 and B. And two others, one was cancelled before it
9 started, and the other construction was stopped because
10 of lack of further need.

11 Q. The second to last you spoke of, when
12 you say cancelled before started, cancelled before
13 construction was started or cancelled before the plant
14 was put in-service?

15 A. I don't know if Mr. Daly can help me
16 here, but I think Bruce Heavy Water Plant "C" was
17 cancelled before we even started construction.

18 MR. DALY: A. That is my recollection,
19 and plant "D" was, as Mr. Penn says, further ahead
20 before it was halted.

21 Q. Has there been any analysis of how
22 much money was spent on these various facilities that
23 were not finished or were retired before their expected
24 retirement date?

25 MR. PENN: A. Well, yes. This matter is

1 reviewed with the Ontario Energy Board on a regular
2 basis and provisions are made.

3 Q. Well, I understand that there is an
4 analysis of how the capital that was presumably sitting
5 there accumulating interest is going to be spread out
6 and borne by different customers, but I am wondering if
7 anybody has added it all up.

8 [11:15 a.m.]

9 A. I have no idea. I haven't added it
10 up.

11 Q. Are we talking millions, tens of
12 millions, hundreds of millions?

13 A. I'm sorry, I don't know, Mr. Poch. I
14 would imagine it's certainly more than tens of
15 millions.

16 Q. And would it be fair to assume it's
17 certainly more than hundreds of millions?

18 A. I don't recall the cost of the heavy
19 water plants.

20 Q. Now, it might be suggested, and
21 perhaps some have suggested it, that the Update which
22 seeks to avoid early commitments to either nuclear or
23 fossil, may have been - I think the phrase was -
24 politically motivated.

25 So I wanted to ask you, Mr. Penn, you

1 have been quite forthright about your fondness for
2 nuclear and you have indicated you have been in the
3 business for 37 years, you have also worked with the
4 system planners for many years; fair?

5 A. I have had contact with system
6 planning division since about 1985.

7 Q. All right. Is it your opinion from
8 the information you have seen and discussions you have
9 had with these planners and from your judgment of their
10 judgment, would it be your belief that the choice in
11 the Update was merely a political decision, or do you
12 believe they have exercised professional judgment.

13 MS. HARVIE: Mr. Chairman, I have to
14 object to this question. This is surely a question
15 that if proper at all it should be put to the planners
16 themselves.

17 MR. D. POCH: I assume the planners will
18 say it was professional judgment.

19 THE CHAIRMAN: I don't think his view
20 about what he thinks someone else's inner thoughts were
21 are of very much use to us, so I don't think he has to
22 answer that question, or any related question.

23 MR. D. POCH: Mr. Penn, you agreed with
24 Mr. Heintzman that nuclear was the best option, you
25 gave three particular criteria you discussed with him

1 for that, and I am sorry, you didn't agree it was
2 necessarily the best option, you agreed it was best
3 under three particular criteria, and I recall they were
4 carbon, Ontario content and cost, which you added the
5 caveat assuming need. Do you recall that?

6 THE CHAIRMAN: I'm sorry, I didn't hear
7 that.

8 MR. D. POCH: Carbon dioxide emissions.

9 MR. PENN: And the third one was cost?

10 MR. D. POCH: Q. Cost. And I recall you
11 placed a caveat on that and you can confirm this for
12 me, that is of course assuming need.

13 MR. PENN: A. I think I told Mr.
14 Heintzman - at least I tried to - that there were a
15 whole series of characteristics of various options, and
16 we were going through at the time the Exhibit 3, the
17 original DSP, and I think we were going through what
18 characteristics led to the choice of Plan 15 as the
19 preferred plan. And I really felt Mr. Heintzman only
20 led me through three.

21 Q. All right. And I just wanted to be
22 clear, the views you expressed were comparing nuclear
23 to fossil, they weren't comparing nuclear to
24 conservation or DSM, were they?

25 A. Well, I don't really remember the

1 context. I would have to go back to the transaction.

2 Q. You would agree with me that DSM
3 emits no carbon certainly.

4 MS. HARVIE: I don't know how this
5 witness can answer that. Surely Mr. Poch should have
6 put those questions to witnesses on Panel 4.

7 MR. D. POCH: I am afraid you didn't
8 object to Mr. Heintzman taking him to these comparisons
9 and I was trying to do the parallel, that's all.

10 MS. HARVIE: He didn't ask that precise
11 question, Mr. Chairman.

12 MR. D. POCH: No, he asked it with
13 respect to fossil.

14 Q. Mr. Penn, do you feel uncomfortable
15 answering that question?

16 MR. PENN: A. I will try and be helpful
17 but there is a limit to my responsibility or knowledge
18 in this area.

19 Q. All right. And, Mr. Penn, in
20 fairness to you, you are not an environmental expert?

21 A. I wouldn't say personally I was an
22 environmental expert, no. We have Mr. Johansen on the
23 panel who deals with environmental matters.

24 Q. Nor are you an economist, and I take
25 it you would be unable to help us with what the Ontario

1 content of DSM is, for example.

2 A. If I knew what the content was, I
3 would certainly tell you. I don't know.

4 Q. And I think you referred to a jobs
5 number, which was in one of the little brochures which
6 I will try to find. It's Exhibit 566. I think you
7 agreed that there were -- I think the number was
8 100,000 jobs in the Canadian nuclear industry. Page 13
9 of that piece. I don't know that you need to turn it
10 up, Mr. Penn. My question really is --

11 A. The only reason that I am wondering
12 where it is, maybe someone can find it for me, the
13 numbers that stick in my mind are that the number of
14 direct jobs is something of the order of 32,000 and the
15 number of indirect jobs is of the order of 80,000.

16 Q. And 32,000, that's about the
17 equivalent of the entire work-force of Ontario Hydro?

18 A. That's correct, yes.

19 Q. And, Mr. Penn, is that from some
20 study that you have analyzed and are familiar with or
21 are you just --

22 A. No, it is just a number that I guess
23 I store in my computer up here.

24 Q. And, Mr. Penn, again, you are not
25 suggesting, you are not offering yourself as an expert

1 in job multipliers?

2 A. No, I am not.

3 Q. That is fine.

4 I would like to turn to lead time
5 estimates. First of all, Mr. Penn, could you tell me
6 what the phrase E16N is?

7 A. Well, in Hydro - and this going back
8 about maybe more than 10 years - we used to number
9 planning studies E for east, I think, N for nuclear.
10 And it would be in the case you have given the 16th
11 study since the numbering started in, I think probably
12 maybe in the 60s. And of course if it was a fossil
13 plants it would be 16F.

14 Q. Did you happen to recall what the
15 study E16N was about?

16 A. It may have been Darlington, I don't
17 recall.

18 Q. You don't recall.

19 Mr. Penn, could you turn up Exhibit 519,
20 page 78.

21 A. Could you describe to me what 519 is?

22 Q. It's your overheads.

23 A. Thank you.

24 Q. It was a long time ago, Mr. Penn.

25 A. Well, there are quite a lot of

1 numbers to remember.

2 Q. There hasn't been an update to the
3 overheads, has there?

4 A. Page 78.

5 Q. Page 78.

6 First of all, I can't help observing in
7 the upper line it's noted: DSP hearings finished,
8 nuclear moratorium lifted October 1st, 1999. I hope
9 that isn't a typical Hydro underestimate.

10 A. I think you may have been out of the
11 room or not here on the day that we had a little laugh
12 about that.

13 Q. In fact, could you just tell me what
14 the correct assumption is there for the rest of this
15 table to make sense?

16 A. Well, when this type of format was
17 first produced it was with regard to plotting lead
18 times for earliest in-service of an option.

19 And because you have got to have a start
20 date to define an end date, we made the assumption that
21 the earliest date the nuclear moratorium could be
22 lifted would be June 1993.

23 Now, of course, in this particular
24 example, the nuclear moratorium could be retained for a
25 longer period.

1 Q. Just so I understand this then, the
2 way this table is constructed it really was, I assume,
3 constructed from back to front. You said if we want to
4 satisfy a need date of 2010, when we would need to
5 begin, and it is, I take it, October 1st, 1999 you
6 would have to have approval?

7 A. I asked my staff, because we are
8 interested now at this hearing in in-service around
9 2010, to produce this lead time graph for me. But of
10 course, the detail to get it is consistent with the
11 same sort of graph that we came up with for earliest
12 in-service. We haven't changed, for example, the
13 construction period or indeed the 24 months, for
14 example, for the approval of the environmental
15 assessment.

16 Q. Now, Mr. Penn, where I am headed with
17 this is that in your evidence in chief you spoke of
18 ranges in lead times and in cost estimates arising from
19 a distinction between new site and existing sites. I
20 wanted to understand what components on this chart
21 would change between those two categories and therefore
22 what the impact would be of each.

23 This chart you could perhaps tell us with
24 this chart what the time impact would be, where it
25 comes about, and if you could at the same time give us

1 some indication of how the cost differential is spread
2 amongst different factors, that would also be helpful.

3 A. Well, maybe we can deal with one at a
4 time and look at lead time first. This particular
5 example, and that's all it is, an example, is the lead
6 time right from the start of the definition phase to
7 in-service of a CANDU 6 single unit, 670 megawatts, at
8 the Darlington site, assuming that we use our
9 Liebermann crane to put in the steam generators through
10 the top of the building. That's what open top
11 construction means.

12 Now, if we were to take, for example, a
13 new site, and we have at various times focused on the
14 North Channel area because you have got to have in mind
15 what different topography or what different cooling
16 water, or whatever, to come up with a change in lead
17 time, but as an example, we chose North Channel, so
18 that working from the bottom right of this figure, and
19 I am looking now at the 59 months construction, it is
20 our judgment that if you were building at the new site
21 and in a colder climate than at Darlington, then you
22 would add another 12 months to that construction period
23 and you would come up with 71 months.

24 We would also, moving now again to the
25 left, under site preparation and excavation, we would

1 assume that for a new site of that nature, that instead
2 of being 16 months it would be at least 30 months.

3 Q. So an additional 14.

4 A. Yes. And the reason for that is that
5 the Darlington site happens to be already partially
6 cleared due to the building of Darlington itself.

7 We wouldn't expect any difference in time
8 from the Environmental Assessment Board approval of the
9 environmental assessment document, to the Ontario Hydro
10 board approval or the Order in Council.

11 Q. I notice that there is a site
12 acquisition line, would that be different?

13 A. No, because we would assume, or we
14 have assumed that it would be appropriate to review
15 available sites and to negotiate with the owners if it
16 was in private hands, while the environmental
17 assessment process was continuing.

18 Q. If you couldn't for legal constraint
19 reasons, what have you, how long does the site
20 acquisition process take? Let's assume you had to
21 expropriate, how long does that expropriation phase
22 take, and for simplicity let's assume you get approval
23 to expropriate from a Joint Board as part of the EA,
24 along with the EA approval?

25 A. Well, subject to check, I think that

1 we have assumed that if that happened, it might take 30
2 months.

3 THE CHAIRMAN: And you scheduled it to
4 the end of the EA process, would that be right?

5 MR. PENN: If that was the ruling, Mr.
6 Chairman. But in our assessments of lead times, we
7 have assumed that such an activity is at the risk of
8 Ontario Hydro, therefore it's not additive.

9 MR. D. POCH: Q. Mr. Penn, I won't get
10 into an argument with you about whether there is a
11 distinction between the risk of Ontario Hydro and the
12 risk of Ontario.

13 Are there any other lines that would
14 change?

15 MR. PENN: A. Yes, we have assumed that
16 the first activity, that is putting together the
17 environmental assessment document, you will note it's
18 18 months for the Darlington site, and that is because
19 we have a very large amount of information on the
20 Darlington site, that that period of time would be
21 about - and I would have to check this again - but
22 about 30 months.

23 Q. So an additional 12, or an additional
24 13?

25 A. Yes.

1 Q. Additional 12.

2 A. On the basis or the assumption that
3 we didn't have any environmental information on that
4 sighting.

5 Mr. Johansen may be able to help me, but
6 we would need to conduct environmental measurements
7 over probably two full seasons, two full years in other
8 words, so that we had data in two sets of springs, for
9 example, or two sets of falls.

10 MR. D. POCH: I am going to have some
11 questions about that, so before we get to Mr.
12 Johansen's comment, perhaps, Mr. Chairman, it might be
13 an appropriate place to break.

14 THE CHAIRMAN: We will break for the
15 morning for 15 minutes.

16 THE REGISTRAR: Please come to order.
17 This hearing will recess for 15 minutes.

18 ---Recess at 11:35 a.m.

19 ---On resuming at 11:55 a.m.

20 THE REGISTRAR: Please come to order.
21 This hearing is again in session. Be seated, please.

22 THE CHAIRMAN: Mr. Poch?

23 MR. D. POCH: Thank you, Mr. Chairman.

24 Q. Just before we broke, Mr. Johansen, I
25 think you were going to offer any information you might

1 have on this question of environmental assessment
2 document preparation for a new site?

3 MR. JOHANSEN: A. Yes. For a new site
4 the rule of thumb for planning purposes that we have is
5 to allow time for pre-environmental assessment scoping
6 and time to carry out at least one full season, or one
7 full year rather, of baseline environmental studies and
8 to carry out what we call pre-submission consultation,
9 and finally, to prepare the environmental assessment
10 document.

11 All of that these days is taking 2-1/2
12 years in our view, the 30 months that Mr. Penn was
13 talking about.

14 Q. So the additional 12 that Mr. Penn
15 spoke of is consistent with your appraisal?

16 A. Yes.

17 Q. Now, Mr. Penn, were there any other
18 categories that would expand in time?

19 MR. PENN: A. No, I think I went through
20 the whole lead time working from right to left.

21 Q. Okay. And the second half of my
22 question then was: If you could apportion -- and I
23 appreciate this may be a ballpark estimate on your
24 part, but if you could apportion the differential in
25 cost between the option and a new site as opposed to an

1 existing site to these different categories?

2 A. Well, I think my direct evidence
3 provided ranges of costs for the terms of levelized
4 unit energy costs for an existing site, which would be
5 the lower value, and a new site, which would be for the
6 higher value. So I think we provided it for you for
7 the total campaign.

8 Now, I am afraid I don't have in my head,
9 and it would certainly take some time work it out in
10 LUEC values for each component, but I can certainly
11 talk about it in general terms.

12 Q. Yes. In fact, that is all I am
13 after, general terms.

14 In particular, I am interested in the
15 split in the differential as between sort of hard costs
16 that are incremental, additional site preparation,
17 excavation, site acquisition, as opposed to costs
18 associated with the extra time. Is that something that
19 you have any feel for?

20 A. I think I would be guessing today.

21 Q. Is it something that you could work
22 out at least in an approximate fashion and provide us
23 at a later date?

24 A. I think that is possible, but if you
25 think about the preparation of the environmental

1 assessment, for example, we have just mentioned that
2 instead of being 18 months for an existing site as
3 shown on this chart it would be 30 months. So I would
4 think that the preparation of the environmental
5 assessment, and all the field activities, and all the
6 pre-consultation with the communities affected, and
7 with the ministries involved would cost, if you want it
8 in today's dollars --

9 Q. Well, perhaps I can help you, Mr.
10 Penn. I added up the figures, and they came to 38 or
11 68, depending on the expropriation scenario.

12 Can you give us an indication of --
13 really my question simplified then is: Of the
14 differential in LUEC that you have offered in your
15 evidence in chief could you figure out at your leisure
16 how much of that is simply related to time?

17 And we have already spoken earlier about
18 your rules of thumb for time. And I would be prepared
19 to accept that just using a rule of thumb calculation.
20 Does that make it easier for you?

21 A. Well, I am not sure that that would
22 give a complete answer, and I think we would probably
23 have to think about this a bit. And since you have
24 said we can do it leisurely...

25 Q. All right. Can I take that as an

1 acceptance of an undertaking?

2 THE CHAIRMAN: Next undertaking number,
3 please?

4 THE REGISTRAR: 532.7.

5 ---UNDERTAKING NO. 532.7: Ontario Hydro undertakes to
6 provide a breakout of the difference in
7 LUEC costs between CANDU 6 on a new site
8 and CANDU 6 on a Darlington site
9 attributable to additional time for the
10 activities shown on page 78 of Exhibit
11 519 as opposed to additional expenses
12 other than from the additional time.
13 Also, the financial indices for the
14 extended years for the new site beyond
15 the existing site.

16 THE CHAIRMAN: Perhaps that undertaking
17 should be articulated so we know what we are --

18 MR. PENN: I think it is important to do
19 that, Mr. Chairman.

20 MS. HARVIE: I have a question. If Mr.
21 Poch is asking simply what the costs are related to
22 time is he referring to interest costs? Because it
23 seems to me if you are doing a study over 18 months or
24 over 30 months there are costs of keeping people on the
25 job for an additional 12 months.

26 It is not clear to me at any rate how we
27 can attribute a certain amount to time as distinct from
28 the activity itself.

29 THE CHAIRMAN: Well, I think that is a
30 good point. We are starting with the lead time of a

1 CANDU 6. That is the basic thing. And what 519.78
2 provides is the lead time for a CANDU 6 at the
3 Darlington site.

4 MR. PENN: Yes, sir.

5 THE CHAIRMAN: And the differential that
6 Mr. Poch is interested in is first of all what the lead
7 times would be if it were a new site, and that has been
8 gone through in the last half hour or so.

9 Now, then, what Mr. Poch would like, as I
10 understand it, is what would the additional costs be
11 for those changes in lead time; is that correct?

12 MR. D. POCH: That is right, Mr.
13 Chairman.

14 And perhaps in a nutshell, then, what I
15 am after is of the total differential in LUEC between
16 CANDU 6 on a new site and a CANDU 6 on a Darlington
17 site how much is attributable simply to the delay
18 involved as opposed to the expenses.

19 THE CHAIRMAN: Well, not just the delay
20 involved; it is the additional time it takes to do it.

21 MR. D. POCH: That's fair, Mr. Chairman.

22 THE CHAIRMAN: Because of it being a new
23 site.

24 The general rule of thumb, as I recall
25 the evidence, is that if you just go to the right-hand

1 bottom of the critical path and say how much longer is
2 the in-service date going to be as a result of all
3 these things, it would be 1 per cent a year on the
4 LUEC. Is my recollection right about that - .8 to 1
5 per cent, something like that?

6 MR. PENN: Yes, that's right, sir.

7 THE CHAIRMAN: So that is a ballpark of
8 it; is that right?

9 MR. PENN: That's right.

10 MR. D. POCH: And I think Mr. Penn's
11 concerned that may not be --

12 MR. PENN: To be clear, that is really
13 for a particular site rather than a comparison between
14 a new and an existing site.

15 What is in my mind is that, as Ms. Harvie
16 quite rightly mentioned, the activities for a new site
17 could be different clearly, and one has to make
18 assumptions therefore on the nature of the site, for
19 example.

20 Here we are getting into somewhat
21 hypothetical areas, but we can certainly make
22 assumptions and come up with the extra cost.
23 Obviously, if the topography of the site is different
24 from Darlington, for example, then the cost of clearing
25 that site is not just a matter of time; it is a matter

1 of the activity.

2 MR. D. POCH: Q. Perhaps I may be
3 proceeding on a misunderstanding, then. I had assumed
4 you had made assumptions and you had costed it out and
5 that was the basis of your evidence in chief.

6 MR. PENN: A. We can provide the
7 information.

8 MR. D. POCH: All right. Perhaps, then,
9 the undertaking in simple terms, Mr. Chairman, would
10 be: A breakout of the difference in costs in LUEC
11 costs between CANDU 6 on a new site and CANDU 6 on a
12 Darlington site attributable to additional time for the
13 activities shown on page 78 of Exhibit 519 as opposed
14 to additional expenses other than from the additional
15 time.

16 Is that clear enough for you, Mr. Penn?

17 MR. PENN: Yes.

18 DR. CONNELL: Are the two options to come
19 in-service at the same time so you just start earlier
20 in one case? Is that the assumption?

21 MR. D. POCH: If that is most convenient
22 for you, Mr. Penn, that is certainly acceptable.

23 MR. PENN: That's fine.

24 MR. D. POCH: Q. Actually, on
25 reflection, Mr. Penn, it would be helpful to have it

1 for us the other way as well, if it makes a significant
2 difference; that is, for a common start of
3 construction, if you will, and --

4 MR. PENN: A. Well, the difference it
5 will make, of course, is that it would be reflected in
6 the financial indices for the extended years for the
7 new site beyond the existing site. That's what the
8 difference will be.

9 Q. Would that be something you could
10 provide us with, then?

11 A. I think so.

12 Q. All right. Thank you.

13 A. On the basis that we will do it as
14 early as possible to do it.

15 Q. Now, could you turn with me to page
16 16 in our second set of materials, which is Exhibit
17 578.

18 I should back up perhaps. This document
19 starts on page 11. It has been given Exhibit No.
20 520.78. It is Report on Major Projects Schedule and
21 Cost Reductions Study, dated December, '89.

22 There is a discussion at the bottom of
23 page 16 about the study direction and the reasons for
24 the authors' of that study assumptions that the
25 Darlington is the preferred location, and they list

1 three reasons, Mr. Penn. Short construction duration
2 for site preparation, we have spoken of that. It best
3 fits the Darlington type station which results in
4 shortest construction period.

5 I take it, then, that that reason is only
6 applicable if we are talking about a 4 by 881?

7 A. Well, the whole study was based on
8 the 4 by 881. I should point out that this was an
9 underlying philosophy. It was an assumption that we
10 would do this work relative to a Darlington site. That
11 doesn't mean to say that Hydro has made any decisions
12 with regard to the site. And indeed, the Environmental
13 Assessment Act requires consideration of all sites and
14 all alternatives to the option.

15 Q. All right. But, in fact, the third
16 reason offered is the applicability of environmental
17 information already collected for Darlington GSA which
18 results in a significant time reduction in the
19 environmental assessment process.

20 A. Yes, we were interested in looking at
21 the shortest schedule and the lowest cost.

22 Q. Fine. I take it that the assumption,
23 then, in your cost estimates for the existing site is
24 that you would not have to do comparable workups of
25 environmental data for other sites before getting a

1 go-ahead for the Darlington site?

2 A. I think I would like to ask you to
3 repeat that question so I can clearly understand it.

4 Q. The assumption in your lead time
5 analysis and your cost estimate for options on an
6 existing site is that you would not be required to do
7 environmental data workups comparable in scope and
8 extent to that that you have for Darlington before
9 being given an approval?

10 A. Oh, I don't think we made that
11 assumption at all. When we looked at the cost for the
12 existing site, which by way of example we took to be
13 Darlington, we had significant data that is noted here.
14 For a new site, of course, we don't have that data.

15 Q. Yes.

16 A. But clearly, we would need that data
17 in order to make any commitment wherever the station
18 might go.

19 Q. Yes, I understand that. I am just
20 saying, though, that the assumption with respect to the
21 facilities that on the existing site is that the
22 go-ahead on those facilities would not be held up by
23 the added length of time required to collect comparable
24 data on other competing new sites.

25 A. If I understand you correctly I

1 disagree with your position because in order to gain
2 approval under the Environmental Assessment Act, and
3 apart from that the many decisions and considerations
4 that Hydro's board itself would want to take, we would
5 be required to look to the similar extent of every site
6 that would be practical.

7 Q. All right. If that is the case, Mr.
8 Penn, then going back to page 78 of Exhibit 519 would
9 you not have to incur those additional 12 months to
10 study these other sites before you could assemble an
11 environmental assessment study that compared these
12 sites to go before an Environmental Assessment Board in
13 a site hearing?

14 A. Yes.

15 Q. All right. So to that extent the 12
16 months really isn't avoidable unless you are somehow
17 exempted from that requirement?

18 A. That's correct.

19 Q. So we should amend then page 78 and
20 extend on the line Environmental Assessment, we should
21 extend that back?

22 A. I don't think we need to amend it.
23 That is a graph, and the title is quite specific that
24 we should just take it in conjunction with another
25 graph that is for a new site. I mean, the two go

1 together. That's all I am saying.

2 Q. You would agree in fact, though,
3 because of this requirement that you have just
4 indicated if you actually did start on October 1st,
5 1999, you would not be able to put the CANDU 6 on the
6 Darlington site on January 1st, 2010 because you would
7 have had to face an additional 12 months at the front
8 end to do a comparable job and environmental workup for
9 other sites?

10 A. Yes, I agree. And I can tell you
11 exactly what it means. It means that for the new site,
12 CANDU 6 on a new site, the EA submission date to the
13 Ministry and to a board of the Environmental Assessment
14 Board would be January, 2000 instead of April, 2001,
15 and the start of definition phase work instead of being
16 October, 1999 would be very late/early 1998.

17 Q. Fair enough. And do I take it, Mr.
18 Penn, then, that your cost estimates to the extent they
19 were based on this schedule would increase slightly
20 because of the additional time?

21 A. Yes.

22 Q. All right.

23 A. But the main reason for the
24 difference in the cost for the new site and the
25 existing site is not related to producing the

1 environmental assessment document.

2 Q. Fair enough.

3 A. While that is an extremely important
4 activity, I am sure you realize that the cost of
5 putting that together is very small compared with the
6 total project cost.

7 [12:15 p.m.]

8 Q. What is your assumption for purposes
9 of lead time and cost analysis of the nature of the
10 environmental assessment process you will go through?
11 Is it a single hearing or are there two hearings?

12 A. Well, we are assuming that it would
13 be a single hearing. And I guess as a consequence of
14 the Update Plan, Exhibit 452, then this single hearing
15 would determine need as well as options, alternatives,
16 and it would consider site-specific or project-specific
17 information as well. That's my assumption.

18 Now, obviously, the decision of what it
19 shall cover is something for the future.

20 Q. And just finally on this page, I take
21 it that the amendment or the 12-month period we just
22 spoke of for CANDU 6 would be equally applicable if it
23 was a 4 by 881 or any of the other options?

24 A. There are similar additional times.
25 It's not a function of the size of the plant.

1 Q. Okay. Mr. Penn, at the end of your
2 evidence in chief starting at page 21417, you
3 offered -- I understand it's Volume 122.

4 A. Thank you. Yes, I have that page.

5 Q. You offered there five reasons for
6 your confidence in the availability of a CANDU option
7 for an in-service date in the year 2010. Even
8 assuming, that is I take it context was this Board
9 accepts the position expressed in the Update, that no
10 approval be given of a CANDU option at this time, first
11 of all, I take it that was your assumption and this is
12 then a point of your five points?

13 A. I was addressing the question why was
14 it reasonable for Ontario Hydro to expect that either a
15 CANDU or a light water reactor option - options,
16 plural - would be available to us for in-service around
17 2010, because I felt that that was an important issue
18 to address.

19 Q. Did I take your comments correctly
20 that part of the reason for the question is an
21 assumption that no approval is given now and you don't
22 start work on such an option right away and therefore
23 it becomes a relevant concern as to whether or not the
24 option would really be there?

25 A. I think you are right. I think for

1 all these options we probably established that the date
2 for which the environmental assessment should be
3 submitted for approval is sometime hence.

4 Q. All right. And if I can just touch
5 on those reasons.

6 The first, according to my notes, is that
7 significant Canadian industry will be required to
8 maintain and improve the performance of Ontario Hydro's
9 current nuclear stations.

10 Is my understanding correct that the
11 point there is you don't need to commit to a new
12 station now because you will be maintaining a nuclear
13 expertise, Canadian industry, the nuclear industry will
14 be maintaining expertise in any event?

15 A. Yes. Well, what I had in mind there
16 was to demonstrate that the infrastructure necessary to
17 support a future nuclear commitment, would be
18 maintained by the industrial effort and that of
19 consultants and Hydro itself to maintain and improve
20 the performance we talked about so much of our existing
21 system. And that there is such a variety of tasks
22 there that disciplines would be maintained.

23 Q. So, in effect, you are not concerned
24 about satisfying your strategy element maintained to
25 the CANDU option. What you are saying is this, in

1 essence, is avoidable so long as the commitment to the
2 existing system persists?

3 A. I didn't have in mind the strategic
4 element in the demand/supply strategy of maintaining
5 the CANDU option when I wrote that paragraph, no.

6 Q. But this would be a relevant point in
7 considering the fulfilment of that objective, I take
8 it?

9 A. It would certainly be part of it.

10 Q. You went on to say, second point,
11 starting line 17:

12 Canadian industry is investing
13 significant effort and funds in the
14 development of evolutionary CANDU single
15 unit stations.

16 And you go on:

17 Enhancement of current CANDU passive
18 is safety systems are being developed
19 which are innovative and will add to
20 public safety assurance.

21 Do I interpret that correctly, that an
22 additional reason for comfort that the option would be
23 there is because companies such as AECL would be
24 pursuing these options for other markets?

25 A. Yes. I was trying to address the

1 CANDU option before I moved to the light water reactor
2 option, and what I had in mind was the knowledge of the
3 considerable funds that Atomic Energy of Canada have
4 invested and continue to invest in the CANDU 3 and
5 CANDU 9 design, and of course in their currently
6 successful campaign to sell plant to Korea, for
7 example, and to complete their plants in Rumania.

8 Q. Yes. Your third point was about LWRs
9 and that they are developing in other countries, I
10 think that's self-evident.

11 The fourth point which starts at line 8
12 of 21418 was that:

13 Both CANDU and light water systems
14 under development are simplified designs.
15 We believe they will be easier to
16 construct and to operate, maintain, and
17 they employ an evolution of proven safety
18 concepts.

19 So, again, I think it is fair to say
20 here, is it not, that we can to some extent bank on the
21 development work of organizations such as AECL of these
22 options, these faster-to-build options?

23 A. Well, not just AECL, but many major
24 companies elsewhere in the world.

25 The message I was trying to convey in

1 that sentence was that there has been a universal
2 recognition that moving towards a simplified approach,
3 you have got to understand the definition of what that
4 means, it means avoiding unnecessary complexity; it
5 doesn't mean that we are reducing or people are
6 thinking about reducing the safety values in the
7 design. In fact, quite the reverse. But if plants are
8 simplified in designs it follows that they are easier
9 to build and perhaps more importantly, easier to
10 maintain and operate. And that is why people in the
11 nuclear industry feel that the philosophy being adopted
12 in the future will lead to improved nuclear plants in
13 the next century compared with this century.

14 And furthermore, there is a large
15 concentration on adopting proven safety concepts. And
16 where it can be clearly demonstrated that passive
17 features are totally reliable, adopting them, because
18 they in turn reduce things like piping lengths and
19 numbers of valves, and the like in a plant, and that's
20 a simplification as well.

21 Q. So perhaps ironically we could say
22 for the reasons you have just spoken of, a decision not
23 to commit to a particular nuclear plant design now, to
24 put that decision off as long as possible may in fact
25 make available to you options which are that much more

1 enhanced. It may improve nuclear's chances in simple
2 terms; is that fair?

3 A. Well, I can understand why you would
4 put it that way, but in my mind it emphasizes the fact
5 that the lead times and the costs of future plants are
6 likely to be more confidently accepted.

7 I don't accept the view that the present
8 plants are not fully acceptable. I think they are
9 fully acceptable.

10 Q. I wasn't trying to put that in your
11 mouth, Mr. Penn. I am simply saying though that there
12 will be, there may be or indeed you are projecting that
13 there will be further advantages as these designs
14 evolve.

15 A. There is in most technology.

16 Q. All right. And some of these points
17 we have spoken of just now involve placing some
18 reliance on the health of AECL if one is interested in
19 preserving these options, the CANDU specific options;
20 is that fair?

21 A. Well, I am sure that a lot of people
22 are interested in the health of Atomic Energy of Canada
23 Limited, after all it is a national company.

24 Q. But do you take my point that to some
25 extent the confidence you have that the option will be

1 there is enhanced if AECL continues to be, and if that
2 were not the case, you would be placing a greater
3 reliance on other organizations?

4 A. Well, the stronger AECL is in the
5 future, the more confidence we can have that future
6 CANDU nuclear options will be available for this
7 province.

8 Now clearly, I mean, all sorts of
9 business arrangements could be conceived of, and I
10 think it's speculative at this time to convey the
11 thought that if AECL went out of business, that that
12 would be the end of the CANDU option. I think it is
13 totally speculative.

14 Q. Indeed, there is a possibility that
15 for any number of circumstances, AECL being privatized
16 what have you, there may remain that potential, indeed,
17 I should add, if there is a market out there for that
18 product one can pretty well assume there would be that
19 potential, and that's an assumption you are prepared to
20 make.

21 A. Well, there appears to be at this
22 time a stronger reason to believe that companies
23 involved in the nuclear business are going to do better
24 in the future than they have in the last 10 or 15
25 years, because countries need electrical energy and

1 nuclear is one of the options.

2 Q. Excuse me for a moment.

3 Could you turn up 75, Exhibit 519, of
4 your overheads?

5 A. Yes, I have that.

6 Q. I was struck by the fact that the
7 proven option that you have already built has a longer
8 lead time than the CANDU 6 which you categorize as
9 proven but which you have not ever built, and then even
10 shorter than that are the evolutionary CANDU 3 and 9
11 designs.

12 I wanted to understand, to what extent is
13 that due to the different technology as you spoke of,
14 the open top construction for the 3 and 9, as opposed
15 to the fact that they aren't multi-unit. Does the fact
16 of a multi-unit design extend lead time?

17 A. Well, just commenting first on the
18 open top construction, that was pioneered for
19 Darlington. That's why we purchased at that time the
20 largest mobile crane in the world, we had it specially
21 built for putting steam generators in Darlington. So
22 that has nothing to do with the question you have
23 asked.

24 What is important in the multi-unit
25 station, that Hydro-type design, is the fact that we

1 have to put in place the common services, that of
2 course is ultimately shared by all four units in place
3 in order to place in-service the first unit of the
4 four, and that takes longer because it's more
5 extensive, than the services required for a single
6 CANDU 6. So that is one reason.

7 Turning to the evolutionary CANDU 3 and
8 9, the reason why these lead times are shorter, and I
9 am convinced that they are appropriately shorter,
10 although you will see that it is not tremendously
11 significant, it's 11 months between the CANDU 9
12 evolutionary and the proven CANDU 6 on an existing
13 site. The reason is that the CANDU 3 and 9, like a lot
14 of these new evolutionary plants being designed, are
15 designed with modulization of construction in mind, and
16 that allows parallel activities on site and in
17 factories. The complete wiring and plumbing and
18 concrete work all in an assembled model to be moved in
19 place, just hooked in. And that sort of technology
20 that we discussed earlier in Panel 9's cross-
21 examination was pioneered by the shipbuilding
22 industries.

23 So that is the basic reason.

24 [12:35 p.m.]

25 Q. All right. Would it be possible, Mr.

1 Penn, for you to provide us - and you don't need to do
2 it now - just with the different numbers that make up
3 the range in your various lead time and cost histograms
4 that are at the back of Exhibit 519?

5 I see what we have is going from existing
6 site -- in some of them, existing site to new site, but
7 also, for example, the lower end of the range might be
8 the CANDU 9 on an existing and the upper end would be a
9 CANDU 3 on a new, and I am just wondering if it is
10 possible to sort out the different options so that it
11 is...

12 A. If you feel that my evidence during
13 cross-examination has not been clear on this subject --

14 Q. I didn't mean to suggest that, Mr.
15 Penn. You have been quite clear that at one of the
16 range -- for example, if we were to look on page 75,
17 lead times, the bottom bar, the bottom end of the
18 range, I think you have made clear, is CANDU 9 on --

19 A. It's actually CANDU 3.

20 Q. I'm sorry, CANDU 3, is that on an
21 existing?

22 A. Yes, it is.

23 Q. And the upper end of the range is
24 which CANDU?

25 A. Candu 9 on a new.

1 Q. All right. And so really I am just
2 asking for the other information that we could get
3 which would be what would CANDU 3 on a new be and what
4 would...

5 A. We can do that.

6 Q. Did you understand the distinction I
7 am drawing here?

8 A. We can do that, but when we come to
9 costs - I think it was yourself that brought the
10 Board's attention to a very detailed answer to an
11 inquiry from IPPSO which provided extensive financial
12 information. I don't think we can possibly do any more
13 than that.

14 Q. You are absolutely right, and that
15 was the interrogatory which was given the number
16 520.68, and you have also told me how I can move them
17 to common end dates. So it is really the lead time
18 ones that I am after.

19 Perhaps we should get an undertaking,
20 then.

21 THE CHAIRMAN: Isn't all in 519.81, the
22 lead time for each one of them?

23 MR. D. POCH: Well, again, Mr. Chairman,
24 the difficulty is the --

25 MR. PENN: Well, it is actually, Mr.

1 Chairman. I had forgotten page 81.

2 All you need to do, Mr. Poch, is if you
3 look at the right-hand, far right-hand column headed
4 Lead Time Months, if you would like to write existing
5 site on the left-hand side of that box and new site on
6 the right-hand I think you have got it, because we
7 didn't combine any of the options in this table.

8 MR. D. POCH: Q. All right. I take it,
9 then, is the lead time under the CANDU 6 line, it is
10 the same whether it is 1, 2 or a 4?

11 MR. PENN: A. Well, the lead time is
12 defined here to mean the lead time for first unit
13 in-service.

14 Q. Then that is helpful. Thank you. I
15 just wanted to touch on a question of capital additions
16 and capital modifications, just a couple of questions.

17 You have provided some information at
18 page 67 of page 519, and in your evidence I believe you
19 stated that most of the capital modification, the
20 higher capital modification budgets in the earlier
21 periods are attributable to the "A" stations, and we
22 have discussed a number of programs such as
23 environmental qualifications and such; is that fair?

24 A. Yes. They are actually listed on
25 page 66, the main ones, in the period of time.

1 Q. I'm sorry, which page?

2 A. Page 66.

3 Q. Of which document?

4 A. Of 519, if I am understanding your
5 question properly.

6 Q. Oh, I'm sorry, I think it is page 65.

7 A. Oh, you are quite right, 65. The
8 copying machine has cut it off somewhere.

9 Q. Is it fair to say that a lot of these
10 modifications have been upgrades to enhance the older
11 stations' systems for safety or whatever reason to
12 bring them more in line with current understanding,
13 current capabilities, current regulatory requirements,
14 and so on?

15 A. Well, some of them are. If you go to
16 page 65--

17 Q. Yes?

18 A. --for Pickering "A" improvements on
19 emergency coolant injection clearly is a safety
20 improvement, and Hydro's policy, as is the AECB's
21 policy, that where it is practical to make improvements
22 and it is warranted we do it.

23 Also, there was improvements to the
24 emergency coolant injection at Bruce "A", but you
25 can -- and floods detector replacement in Pickering "B"

1 is related to safety.

2 Q. Power house protection would be
3 another example?

4 A. Pardon?

5 Q. Power house protection in Pickering
6 "A"?

7 A. Power house protection would be
8 another example.

9 But, on the other hand, heavy water
10 upgrading plant is a reliability issue. Auxiliary used
11 fuel bay, obviously it is necessary to store used fuel
12 as the inventory grows, so we need new bay and we built
13 one.

14 Fuel handling extension at Bruce "A" is
15 connected with reliability. Steam generator cleaning
16 is reliability. Moderator heat exchanger replacement
17 of course was necessary because of corrosion of the
18 tubes in that heat exchanger. And then, of course,
19 there are things like site security that we felt was
20 necessary to improve.

21 Q. That would be more analogous to the
22 category of new regulatory requirements. The world has
23 changed, hasn't it.

24 A. It is to keep people out when we
25 don't want them in.

1 Q. You couldn't be referring to my
2 clients because you gave them a tour yourself. I'm
3 sure you are thinking of someone else.

4 A. Of course. There is no regulation
5 that I am aware of, unless Mr. King is, by the AECB for
6 site security.

7 A. And then the amenities building, just
8 to complete this, is a building that is currently under
9 construction and will be used with the retubing for
10 various facilities, for retubing the Bruce "A"
11 reactors.

12 Q. Mr. Penn, I am wondering to what
13 extent we could expect in the younger stations, the "B"
14 stations and in future stations, that as they get into
15 their second or third decade of service they too would
16 face requirement for capital additions for these
17 categories, if you will, of changes, regulatory
18 changes, parts wearing out and affecting reliability,
19 and so on.

20 Would you agree that to some extent this
21 is a function of how old the unit is?

22 A. Well, to some extent it is, and the
23 ONCI document, Exhibit 43, provides all that data of
24 what we have assumed for capital modifications actually
25 for a new plant. There is a whole chapter on that

1 subject.

2 Q. Yes. And you have provided it here
3 in a graphic form?

4 A. It is included in these cost curves
5 that I have provided.

6 Q. Yes. And we can see it perhaps
7 clearest at page 67?

8 A. Yes.

9 Q. All right. Can I just ask, within
10 the grey shaded range of expectations which number has
11 been used for calculating the LUEC of a new facility?

12 A. We used a mean value in that case.

13 Q. Could you turn the page over to page
14 68? There you have compared the remaining life cost
15 estimate comparison for the Bruce "A" station,
16 including the possibly anticipated refurbishment, with
17 whatever the other option, which is \$4.5 billion.

18 The 4.5 billion, where did that come
19 from; can you tell me?

20 A. Well, it is a present value
21 calculation, including the capital, the fueling and the
22 OM&A, in this case the 4.5 billion using existing
23 fossil and new combustion turbine units subsequently
24 converted to combined cycle. And the reason for that
25 combination and the purpose for doing this was to

1 demonstrate that we look very carefully when making
2 decisions to rehabilitate major plant whether there is
3 proper value in doing so.

4 The assumption is that if you didn't
5 rehabilitate Bruce "A" four units that you would
6 declare them out of service at the date that you would
7 start retubing them. There would be no point in
8 retubing.

9 Q. So what is the time period, then?

10 A. Well, the retubing of Bruce Unit 1 is
11 currently scheduled for - I think Mr. Daly could help
12 me here - but I think it is spring, '94.

13 MR. DALY: A. That's correct.

14 Q. So I see that in this graphic you
15 have just chosen 1991 as the start date then. You have
16 taken the cost stream that you believe you would
17 otherwise face from '91 until the planned retirement
18 dates?

19 MR. PENN: A. This is the total cost
20 from 1991, i.e. today. What it means by unit planned
21 retirement dates is the date when, under normal
22 circumstances, each of the Bruce units would be
23 retired.

24 Q. Assuming the rehabilitation?

25 A. Assuming rehabilitation. So that is

1 typically in the second decade, next century.

2 Q. I was interested in the 4.5 billion
3 figure because of course this is for a period starting
4 right away, and I noted it was the same number that Mr.
5 McCredie used in his appendix 1 in Exhibit 539.

6 A. No, those are totally different.

7 Q. I'm sorry, that's cents per
8 kilowatthour.

9 A. That's LUEC. This is present value
10 costs.

11 Q. All right. Well, perhaps what I
12 could ask then is if you could simply provide us with
13 the assumption -- I know you have already provided
14 information on the 2.7 billion. I am wondering if you
15 could provide us with the spreadsheet or however it was
16 you calculated the 4.5.

17 MS. HARVIE: Mr. Chairman, I believe that
18 has been provided in Interrogatory 9.2.131; am I
19 correct? It was attached to a memo to the Ontario
20 Hydro board of directors approving the rehabilitation
21 to Bruce "A".

22 THE CHAIRMAN: And that interrogatory has
23 already been entered?

24 THE REGISTRAR: I am just checking, Mr.
25 Chairman.

1 THE CHAIRMAN: I think it is one of the
2 earlier ones. It should have been.

3 MR. D. POCH: Q. Mr. Penn, perhaps you
4 could help us here.

5 My understanding of 9.2.131 is that it
6 does indeed go into detail on the 2.7, but it simply
7 takes the 4.5 with the information, the same
8 explanation you have offered in place of -- and I
9 wanted to know what the derivation of that is. I
10 assume that it was derived somewhere and that
11 derivation is available?

12 MS. HARVIE: Well, presumably there was
13 some derivation that formed the basis of the board
14 memo. Surely, though, this would be a question for
15 Panel 10. These witnesses have no knowledge of that, I
16 wouldn't think.

17 MR. D. POCH: Q. Well, Mr. Penn, wasn't
18 it your group who developed this comparison to
19 justify --

20 MR. PENN: A. No. No, it wasn't.

21 THE CHAIRMAN: Why don't we cut this off
22 for a moment and have a look at that 9.2.131 and see if
23 it doesn't satisfy your needs in that respect.

24 MR. D. POCH: Perhaps both Mr. Penn and I
25 will look at that over the break.

1 THE CHAIRMAN: It's just that I am not
2 quite sure what the great significance of having that
3 kind of detail for this, to demonstrate this particular
4 point, I am not quite sure the need for it in any
5 event.

6 MR. PENN: I did indicate in my direct
7 evidence that Panel 10 could give detail on this
8 subject because in fact it is work done by system
9 planning division, not done by my group.

10 THE CHAIRMAN: I mean, what purpose would
11 it serve if it turned out that it should be 4.3 billion
12 or 5.2 or something? What difference does it make? It
13 was just put in there for broad comparative purposes, I
14 would expect.

15 MR. D. POCH: All right, Mr. Chairman. I
16 will have a look at that then.

17 THE CHAIRMAN: Sometime in this hearing
18 we have got to get to grips with what level of detail
19 we really need to make these decisions.

20 MR. D. POCH: Q. I just wanted to touch
21 upon briefly the question of the life expectation, the
22 40-year life expectation for your facilities.

23 Mr. Heintzman asked you about Douglas
24 Point, and if I recall correctly you believed it was
25 jointly owned by at least AECB and Hydro.

1 MR. PENN: A. AECL.

2 Q. AECL and Hydro, yes. And I have a
3 reference here to Exhibit 526. Perhaps we could find
4 that.

5 It looks like this (indicating). This
6 was a document filed by AECL.

7 [12:55 p.m.]

8 In fact, Mr. Penn, it probably is
9 unnecessary for to you take it out. I am really going
10 to ask for your opinion on a fact put forward there.

11 At page F15, in the chronology that was
12 offered, at 1960 it said work began on a 200 megawatt
13 CANDU prototype at Douglas Point on Lake Huron, and I
14 wanted to know if you agree with that description of
15 Douglas Point reactor as the CANDU prototype?

16 A. Yes, I would agree. It was jointly
17 conceived that it was necessary to have a power reactor
18 prototype. NPD of course had been committed a little
19 earlier, but it was only 19 megawatts, and to jump from
20 19 megawatts to 500 megawatts, I wasn't part of that
21 decision, but it was felt that a 200 megawatt sized
22 plant was necessary.

23 Q. And that was to give you some more
24 representative experience before committing to a large
25 CANDU program; is that fair?

1 A. Using parameters that were expected
2 to be in a fully commercial system such as Pickering
3 "A".

4 Q. You would agree with the words I have
5 used, that it was intended give you some information
6 about commercial scale CANDUs so you could judge the
7 merits of committing to a much more extensive --

8 A. We are going back quite a long time,
9 actually I have got some fond memories because that's
10 when I came to Canada, but it's going back a long time,
11 and I think that there was need for experience in
12 operating a large, fairly large CANDU power station and
13 all that knowledge that was required.

14 Q. How old was the Douglas Point plant
15 when it was taken out-of-service?

16 MR. DALY: A. Douglas Point was put
17 in-service in September 1968 and was taken
18 out-of-service in May 1984. So that is approximately
19 between 16 years.

20 Q. What were the reasons for taking it
21 out-of-service?

22 MR. PENN: A. I think I can cover that
23 one.

24 I think probably I should correct one
25 thing that I perhaps said. I believe that the plant

1 was owned, in fact I am almost certain it was fully
2 owned by Atomic Energy of Canada Limited. It was
3 operated by Ontario Hydro staff.

4 AECL determined that retubing of Douglas
5 Point, which would have been necessary shortly after
6 the date that Mr. Daly gave for putting it
7 out-of-service, just would not have been economic with
8 regard to the extended lifetime.

9 Q. Mr. Penn, my recollection is that
10 they even offered to sell it to Hydro for a dollar and
11 Hydro declined, in essence, coming to the same
12 conclusion; is that fair?

13 A. I wasn't party to that, but that's
14 about right.

15 MR. D. POCH: Thank you I am going to
16 turn to a new topic.

17 THE CHAIRMAN: All right. We can adjourn
18 then until 2:30.

19 THE REGISTRAR: Please come to order.
20 This hearing will adjourn until 2:30.

21 ---Luncheon recess at 12:58 p.m.

22 ---On resuming at 2:32 p.m.

23 THE REGISTRAR: Please come to order.
24 This hearing is again in session. Be seated, please.

25 MS. HARVIE: Mr. Chairman, I have been

1 advised over the lunch that the proper title to Exhibit
2 592 that you mentioned this morning filed by Ontario
3 Hydro is Prediction of Incremental System Values of
4 Power and Energy, March 1992. It's an update to at
5 least two previous versions of that document that we
6 have provided. Thank you.

7 ---EXHIBIT NO. 592: Prediction of Incremental System
8 Values of Power and Energy, March 1992.

9 MR. D. POCH: Mr. Chairman, I should I
10 advise you that I will not finish today, but the
11 counsel for Energy Probe has a conflict I think that
12 takes her out of town for some period of time at the
13 end of next week, there was concern about having
14 sufficient time, so I have agreed with her, subject to
15 your consent that wherever I get to at the end of the
16 day, I will stop. She will pick up on Monday, and then
17 I am prepared to finish my cross at the end of Energy
18 Probe's.

19 THE CHAIRMAN: That will be fine.

20 MR. D. POCH: Thank you, Mr. Chairman.

21 Q. Mr. Penn, in your presentation to the
22 Select Committee which was filed as Exhibit 534 in this
23 hearing, at page 23, again I don't know that you need
24 to get it out, you do say there though that -- the
25 heading is Ontario Benefits for Existing CANDUs, and

1 you monetize a reduction in electricity generation
2 costs, and I assume there what you are doing is
3 comparing to the fossil fuel alternative; is that fair?

4 MR. PENN: A. Yes, I think the lead-in
5 sentence refers to using U.S. coal-fired generation.

6 Q. All right.

7 A. Hydro's generation but using U.S.
8 coal.

9 Q. Indeed, you had a discussion with Mr.
10 Heintzman and you reiterated your opinion that the
11 Ontario public has benefited from nuclear power
12 economically; is that fair?

13 A. Yes.

14 Q. Could you turn up page 118A of
15 Exhibit 577, our first volume. On that page and in the
16 following few pages we have provided an excerpt from a
17 study prepared for the Economic Council of Canada by
18 George Lermer. Perhaps I should ask for an exhibit
19 number for that before we proceed.

20 THE REGISTRAR: 596.

21 ---EXHIBIT NO. 596: Atomic Energy of Canada Limited,
22 The Crown Corporation as Strategist in an
 Entrepreneurial Global-Scale Industry.

23 MR. D. POCH: Q. Now, as part of that
24 work, Mr. Lermer analyzed the amount of money that the
25 Canadian government has invested in nuclear R&D and

1 then went on to consider the benefits and costs to
2 Ontario Hydro of CANDU compared to coal. I don't know
3 if you have seen this study before, have you, Mr. Penn?

4 MR. PENN: A. Well, I have glanced
5 through it. I hadn't seen it before you provided it.

6 Q. And just so we can understand what he
7 has done --

8 A. In fact, I don't know who Mr. Lermer
9 is.

10 THE CHAIRMAN: Is there a date on this
11 document?

12 MR. D. POCH: It is from the early 80s,
13 Mr. Chairman.

14 THE CHAIRMAN: Well, if you want to
15 compare what is said by Mr. Penn in 1988 with what Mr.
16 Lermer said sometime, I think we should know when Mr.
17 Lermer said it.

18 MR. D. POCH: His analysis is as of '81,
19 that is clear, Mr. Chairman, from page 118B.

20 THE CHAIRMAN: All right.

21 MR. D. POCH: And indeed, Mr. Chairman,
22 as I think I will be able to show, his analysis is a
23 forward-looking one as well as a retrospective one.

24 Q. In his analysis, Mr. Penn, at our
25 page 118C, he takes the then current figure of 18

1 billion 1981 dollars that he calculated the federal
2 government had spent on a CANDU program. There is a
3 discussion there where talks about Professional
4 Meneley's opinion and his own and he removes from that
5 what he calls a conservative assumption, he removes 6
6 billion which he allocates, of that research, to
7 non-commercial and non-reactor programs.

8 So he then takes the total R&D effort at
9 12 billion for the purpose of CANDU.

10 If you turnover page 118D and on to page
11 118E, at page 118E, he, after having compared Hydro's
12 nuclear and coal costs, compares the saving that CANDU
13 had created or was expected to create to the point when
14 Darlington is on stream. That paragraph highlighted he
15 notes that CANDU has saved Ontario Hydro about \$800 per
16 kilowatt, and the Canadian government --

17 MR. PENN: A. I'm sorry, where are you
18 reading from?

19 THE CHAIRMAN: You may have it
20 highlighted, but we don't.

21 MR. D. POCH: I'm sorry, perhaps it's in
22 the spiral binding. on page 118E it's the first full
23 paragraph, second paragraph.

24 THE CHAIRMAN: On the left-hand side.

25 MR. D. POCH: On the left-hand column.

1 THE CHAIRMAN: It is marked.

2 MR. D. POCH: Q. If we take for granted
3 that the political process would not have
4 allowed Ontario Hydro to source offshore
5 the reactor component of a nuclear
6 generating station, then the CANDU has
7 saved Ontario Hydro about \$800 per
8 kilowatt and the Canadian government has
9 spent for R&D an amount that will
10 translate \$808 per kilowatt once
11 Darlington is on stream.

12 So he has put Darlington in the
13 denominator as well. He goes on to express an opinion.

14 I am just wondering in your analysis to
15 the Select Committee and your reiteration here, have
16 you similarly considered what the subsidy or investment
17 in R&D has been, netted that out, or is your analysis
18 not net of that investment?

19 THE CHAIRMAN: Excuse me, didn't you ask
20 this question yesterday? Wasn't that question
21 yesterday, except it was then called tax funded R&D?
22 Is there a difference in the principle?

23 MR. D. POCH: Yesterday, I believe, I
24 asked him if he agreed that in a forward-looking
25 analysis if tax-funded R&D was avoidable it should be

1 counted, and I think he agreed. Now I am just trying
2 to see what tax-funded R&D has been and see if it makes
3 a difference.

4 THE CHAIRMAN: It's the same thing. It's
5 called different names.

6 MR. D. POCH: Yes, you are absolutely
7 right, Mr. Chairman. And the question previously was
8 whether or not he agreed it should be included in the
9 analysis if it is avoidable in a future looking
10 analysis and he did agree.

11 Now I am looking at what the level of
12 this has been so we can get a sense of whether it has
13 been an important item in the past.

14 THE CHAIRMAN: Mr. Lermer thinks it has
15 been.

16 MR. D. POCH: That's fair, Mr. Chairman,
17 and we can provide the full...

18 MR. PENN: I think I would just like to
19 comment, and we would have to check the transactions
20 for yesterday, but I recall agreeing that the national
21 R&D program in nuclear had been of benefit to this
22 province, and that's as far as I went.

23 MR. D. POCH: Q. Yes.

24 MR. PENN: A. I didn't talk about
25 agreeing that the tax base R&D funding was avoidable

1 and should be charged to the customers of this
2 province.

3 Q. I am not suggesting you agreed it was
4 avoidable. I am suggesting you agreed if it was
5 avoidable it should be. We will let the transcript
6 speak for itself. That's not the point that I am
7 examining now.

8 I am just examining therefore in your
9 analysis where you have asserted there is an economic
10 advantage or there has been, did you take into account
11 in the fashion that Mr. Lermer did for the Economic
12 Council of Canada or in any other fashion, this
13 offsetting cost of investment in R&D for CANDU made by
14 the Canadian government?

15 A. I am sorry, I am not following your
16 question. Could you restate your question simply?

17 Q. You said to the Select Committee and
18 you said to this Board, Ontario has benefited
19 economically from CANDU, and I am just wondering in
20 coming to that conclusion did you weigh in the costs,
21 which I will call subsidies, whether or not you accept
22 that but just so I can use the single word to describe
23 it, from the various governments?

24 A. Well, if I understand your meaning of
25 your word "weigh in" to be included, the answer is no,

1 we have not included.

2 Maybe you want to ask me more questions
3 about this paper, but I have no idea about the standing
4 of the this paper or the voracity of the information
5 given.

6 If I had been asked what the total R&D
7 directly related to the CANDU nuclear program had been
8 I would have had a figure in mind of \$4 billion. We
9 are at considerable differences obviously.

10 And there is a discussion of the nature
11 of the R&D in Exhibit 43 and the chapter is devoted to
12 it, which is the ONCI document.

13 Q. All right. Thank you.

14 DR. CONNELL: Just before we leave this,
15 if we are going to leave it. I have been trying to
16 understand where this 18 billion figure comes from.
17 There is no authority or source cited, and the
18 paragraphs begins:

19 The value as of 1981 of all R&D
20 expenditures for the CANDU reactor system
21 to the end of 1992 total 14 billion in
22 1981 dollars.

23 It doesn't make clear when the counting
24 started, nor does it make clear how you defined an R&D
25 expenditure for the CANDU reactor system.

1 Is there any explanation of those points?

2 MR. D. POCH: Well, Dr. Connell, all I
3 can offer you is the explanation that the author of the
4 paper offers in that paragraph, estimated R&D costs of
5 the CANDU system, where he takes it from 14 up to 18 by
6 adding in a couple of factors. And I think we can
7 assume that's the total R&D.

8 I can file a copy of the entire piece so
9 it will be available to you.

10 DR. CONNELL: I think if it's going to be
11 regarded as evidence it should be filed in full.

12 THE CHAIRMAN: Well, it is not regarded
13 as evidence, I hasten to say. It's only used to elicit
14 Mr. Penn's evidence.

15 If later on the party wants to put it in
16 as evidence, they in most cases would bring the author,
17 Mr. Lermer, here to be cross-examined.

18 DR. CONNELL: I will wait for that moment
19 then, Mr. Chairman.

20 MS. HARVIE: Yes, so will we. [Laughter]

21 MR. D. POCH: Mr. Chairman, I put the
22 document forward simply to show that there is obviously
23 literature suggesting there has been substantial
24 subsidy, and Mr. Penn has agreed that whatever that
25 subsidy may be, he has not included it. And in any

1 event, of course, the question is now going to turn on
2 what future cost trends may be.

3 MR. PENN: I would hasten to add as well,
4 Mr. Poch, and I think I said this in evidence
5 yesterday, that as a nation we try to foster our
6 economy and our industry, our commerce, and this is one
7 of the many programs that we do it and the benefit, of
8 course, is felt throughout society.

9 MR. D. POCH: Q. Mr. Penn, of course
10 that's not peculiar to nuclear.

11 MR. PENN: A. No, I am sure it isn't. I
12 am sure that there is similar research done on all
13 sorts of engineering and science, the National Research
14 Council, for example.

15 Q. And when that's the case, similarly
16 benefits would flow in any number of ways.

17 A. To whatever enterprise pioneered or
18 developed, wherever the product was and whoever
19 purchased it.

20 Q. Yes. All right.

21 Mr. Chairman, I am going to provide for
22 the Board a copy of the Nuclear Liability Act. I will
23 just be referring to it briefly, I won't be asking
24 these witnesses for a legal opinion.

25 MS. HARVIE: Actually, I think, Mr. Poch,

1 that this has already been filed as an exhibit on Panel
2 3.

3 MR. D. POCH: I didn't even think it
4 needed to be an exhibit, it's a statute of Canada.

5 MS. HARVIE: That is fine.

6 MR. D. POCH: Just so it would be
7 convenient to the Board for reference.

8 [2:48 p.m.]

9 Mr. Chairman, I will just mention, so the
10 import of my questions will be in a context, that the
11 Act includes a limitation period in Section 13 of three
12 years and in the absolute no more than 10 years from an
13 incident.

14 Q. And I will start by asking, Dr.
15 Whillans, 10 years is indeed shorter than the latency
16 period for solid tumor cancers?

17 DR. WHILLANS: A. There is usually a
18 range of latency periods given for solid tumors, but 10
19 would be a reasonable minimum, yes.

20 Q. So we would expect the majority of
21 any solid tumors from appearing in the population after
22 an accident to be diagnosable after a 10-year period?

23 A. That has been the experience in Japan
24 certainly.

25 Q. The other feature of the Act that I

1 wanted to --

2 THE CHAIRMAN: But I guess we are not
3 getting into a legal argument, but the limitation
4 period runs from the time that the person making the
5 claim had knowledge or ought reasonably to have had
6 knowledge of the injury or damage.

7 MR. D. POCH: Yes, and that is the
8 three-year period, Mr. Chairman.

9 THE CHAIRMAN: That's right. I mean, so
10 taking a hypothetical, somebody who discovered that
11 they had cancer would then have three years from that
12 time to make the claim.

13 MR. D. POCH: Yes, and that's a normal
14 limitation period and that is the normal way that the
15 law works, but I direct you to the end of Section 13
16 where the words are added "And in no case shall any
17 action be brought after 10 years from the date the
18 cause of action arose, and that, without getting into a
19 long legal argument, to make any sense of having two
20 different periods they must run from different times.

21 It is my understanding that it is
22 accepted that the interpretation I have given it has
23 been accepted by Ontario Hydro in the context of the
24 litigation about this Act.

25 MS. HARVIE: I have no knowledge of that,

1 Mr. Chairman, whether that is true or not.

2 MR. D. POCH: And just in that vein, I
3 take it it is knowledge to you as a Panel that there is
4 in fact litigation under way right now. Energy Probe
5 and 10 scientists and medical doctors, I believe, have
6 challenged the Act under the Charter and under the
7 Constitution.

8 Mr. Chairman, I can advise you, since I
9 did act at one time on that matter, that there was a
10 standing cause of action challenge brought against the
11 case. It went all the way up to the Supreme Court of
12 Canada where Hydro was denied leave to appeal, and so
13 the matter was proceeding, last I checked.

14 Q. Is it your understanding that matter
15 is proceeding still, Mr. Penn, that case?

16 MR. PENN: A. That is about all I know
17 about the subject, that it is ongoing.

18 Q. That is all I wanted to ask you.

19 Now, I am interested in your thoughts on
20 the effect of the Act, not the legal analysis and not
21 simply because there is a possibility that the Act
22 could be struck down, but rather to the extent it helps
23 us understand the externalities of nuclear risk.

24 And we indeed did ask you in an
25 interrogatory, what if the Act were struck down, at

page 119 of our first volume, 577, in Interrogatory
11.7.27.

THE REGISTRAR: .89.

---EXHIBIT NO. 520.89: Interrogatory No. 11.7.27.

MR. D. POCH: Q. Your answer was that
you had not estimated the impact on avoided cost if the
Act was removed, but you also provided us an answer in
response to 9.7.139.

THE REGISTRAR: That will be .90.

---EXHIBIT NO. 520.90: Interrogatory No. 9.7.139.

MR. D. POCH: Q. And that is at page 120
of our materials.

You indicated the following:

No systematic analysis has been
performed as to the consequences to Hydro
of the Nuclear Liability Act being struck
down. Nevertheless, Hydro believes the
consequences of the Act being struck down
could be serious as there is a
significant risk that suppliers to
Hydro's nuclear generating stations might
decide not to continue to supply. Such
actions by suppliers could have a very
substantial impact on the continued
operation of Hydro's nuclear generating

1 stations.

2 Who can I ask about that answer?

3 MS. HARVIE: Well, why don't you pose the
4 question first, Mr. Poch.

5 MR. D. POCH: Q. All right. I am
6 interested in understanding why it is Hydro's position
7 that they would expect or they would see a significant
8 risk that suppliers would pull out if the Nuclear
9 Liability Act fell.

10 MS. HARVIE: Mr. Chairman, as Mr. Poch
11 has pointed out, this matter is before the Courts and
12 that question in my submission bears directly on
13 Hydro's conduct in those proceedings and should not be
14 answered for that reason. I think the interrogatory
15 answer stands for itself.

16 I should point out as well that the last
17 time I looked at the statement of claim there were
18 several members of Mr. Poch's own client who were
19 listed as plaintiffs.

20 MR. D. POCH: I am not aware of that.

21 MS. HARVIE: I could be wrong. That was
22 my impression from looking at it, Mr. Chairman.

23 MR. D. POCH: I understand there are
24 representatives from the Health Coalition is one of the
25 plaintiffs. I am not aware of my clients being

1 plaintiffs.

2 THE CHAIRMAN: I am not quite sure I have
3 quite got the handle on what the problem is. What is
4 it you want to know? This is Hydro's answer to the
5 interrogatory.

6 MR. D. POCH: I am interested in
7 understanding why they come to that conclusion.

8 THE CHAIRMAN: You are suggesting it is
9 not a valid conclusion to come to? Is that what you
10 mean?

11 MR. D. POCH: I am certainly suggesting
12 it is a valid conclusion, Mr. Chairman. I am trying to
13 understand why Hydro believes it is a valid conclusion,
14 and we may agree.

15 MR. PENN: Mr. Poch, I don't think any
16 members of this panel, certainly not me, can add
17 anything to that answer.

18 THE CHAIRMAN: Well, that is the end of
19 it, then.

20 MR. D. POCH: Q. Perhaps you could tell
21 me, then, who made this judgment for Ontario Hydro?

22 MS. HARVIE: Well, that is a completely
23 irrelevant question as well, Mr. Chairman. If this
24 represents the corporate position then who drafted it
25 or approved it is immaterial.

1 MR. D. POCH: This Panel has just told me
2 they can't answer questions about it and I am
3 interested in understanding who I can cross-examine
4 about it.

5 MS. HARVIE: Well, there are a lot of
6 interrogatory responses that we filed in clarifying
7 materials that parties have inquired about, and we
8 don't put forward witnesses to answer every single
9 question that could arise in the course of --

10 THE CHAIRMAN: But if the question is
11 relevant then it should be answered by somebody, you
12 would agree with that; would you not, Ms. Harvie?

13 MS. HARVIE: I would agree, Mr. Chairman,
14 but my submission has been that the question is not
15 relevant.

16 THE CHAIRMAN: And why is that?

17 MS. HARVIE: Well, if the question goes
18 to what the effect would be if the Act were struck down
19 the answer is: We haven't performed a systematic
20 analysis of that.

21 THE CHAIRMAN: But then you go on to say
22 that if the Act is struck down suppliers will not
23 continue to supply or there is a risk of that.

24 MS. HARVIE: Yes. And these witnesses
25 have said that they have no ability to deal with that

1 or at least a limited ability.

2 THE CHAIRMAN: But somebody should be
3 able to answer that for Mr. Poch.

4 MS. HARVIE: Yes. My concern, Mr.
5 Chairman, is that this is a matter before the Courts,
6 and I am concerned that questions are being elicited
7 here that could be used in that proceeding.

8 THE CHAIRMAN: Well, I am not familiar
9 with what the court procedure is and what stage it is
10 at or even what it is about, but you say that the
11 answer to that question would be prejudicial to the
12 court proceeding; is that what you are saying?

13 MS. HARVIE: That may be, Mr. Chairman,
14 yes.

15 MS. PATTERSON: But you have answered to
16 some extent, so I think you have sort of given up your
17 right to claim that you shouldn't have answered it in
18 the first place.

19 MS. HARVIE: Well, we have endeavoured
20 where possible to provide responses to just about every
21 interrogatory that has come our way and we have in no
22 way suggested that in responding to the interrogatory
23 that we have admitted that the material or even the
24 question is relevant.

25 THE CHAIRMAN: Well, I understand. That

1 is what I asked you a moment ago, why you say it is
2 not --

3 MS. HARVIE: It is entirely speculative,
4 Mr. Chairman. As of today's date we have a Nuclear
5 Liability Act, and there is, as Mr. Poch told you, a
6 court proceeding in place to see whether that Act is
7 constitutional, but we have no reasonable basis to
8 assume that it will be struck down at this time, and so
9 to begin to make assumptions what the effects would be
10 if it were struck down are speculative, so speculative
11 as to not be useful to your determination.

12 THE CHAIRMAN: All right.

13 MR. D. POCH: Mr. Chairman, if I could
14 just --

15 THE CHAIRMAN: Now, I have an idea of
16 what you are saying. So you say that the entire
17 discussion of the validity of the Liability Act is not
18 relevant to our determination, that we have to take the
19 law as we find it and not speculate about the
20 possibility of it being struck down. Is that what you
21 are saying?

22 MS. HARVIE: Yes, that's correct, Mr.
23 Chairman.

24 MR. D. POCH: Mr. Chairman, in my opening
25 comments leading up to these questions I thought I had

1 made it clear. I am interested in this not just
2 because there is clearly some possibility that that Act
3 might fall and that is a risk to the Plan, if you will,
4 to the extent it relies on nuclear, and it was not my
5 intention to ask these witnesses to speculate on that
6 risk, but also because the reasoning behind their
7 conclusion that the nuclear industry would not
8 participate without such a liability shield --

9 THE CHAIRMAN: Where is that said?

10 MR. D. POCH: Perhaps I have overstated
11 it, that there is a significant risk that suppliers
12 might decide not continue to supply.

13 The reasoning behind that, the reason I
14 am interested in that is because I think it is
15 indicative of the industry's own view of what the risk
16 associated with nuclear power is and Hydro's assessment
17 of that.

18 Indeed, it will be our argument to you,
19 Mr. Chairman, the existence or non-existence of the Act
20 is - apart from this perhaps potential incapability for
21 the option to be pursued altogether, apart from that -
22 the existence or non-existence of the Act is irrelevant
23 to your consideration of what are the risks.

24 The risks are there whether they are
25 shielded or not, and it is their assessment of the

1 risks, the industry's assessment of the risks which
2 Hydro expresses here that I am interested in.

3 THE CHAIRMAN: Well, you can certainly
4 ask these witnesses all kinds of questions, as many as
5 you like about what the risks are, but I am not sure
6 how helpful it would be to know about their attitude
7 towards a particular piece of legislation. I don't
8 think that there is necessarily a connection between
9 their concern about the absence of legislation and the
10 quantity of the risk.

11 MR. D. POCH: Well, that was precisely
12 why I am asking Hydro what is the mechanism, the reason
13 that they assume for the industry not being willing to
14 participate in the absence of the Act to whatever
15 extent they believe that is a risk.

16 If the answer is, for example, Mr.
17 Chairman, that the industry can't bear the kinds of
18 risks we are talking about I think that is telling of
19 how the industry perceives the risks.

20 THE CHAIRMAN: That is argumentative.
21 ---Off the record discussion.

22 THE CHAIRMAN: We agree with Mr. Poch,
23 that the risk arising from nuclear generation is of
24 course a very relevant issue at this hearing and the
25 existence or non-existence of the legislation which

1 limits liability for certain events has no bearing on
2 our decision one way or the other.

3 However, there may be some interest in
4 pursuing the perception by Ontario Hydro that the
5 elimination of the legislation would indeed cause
6 certain reaction by some of their suppliers.

7 I think what we have decided is that this
8 panel obviously cannot answer that question so no
9 further questions from this line should be asked.

10 The question can be put not as an
11 undertaking but as a question addressed to the
12 proponent in these proceedings, and Hydro will be free
13 if so advised to refuse to answer. If they decide to
14 do that, then we will have to argue it.

15 It is an important issue, and I don't
16 think it can be dealt with in this sort of an ad hoc
17 fashion. Ad hoc may not be the right word, but it may
18 be that if it is considered serious it should be
19 seriously dealt with so the question can be submitted
20 to the proponent. These witnesses do not have to
21 answer it nor any questions arising from it, but if
22 Hydro doesn't wish to answer it, then we will have to
23 argue it at another time.

24 MR. D. POCH: Thank you, Mr. Chairman.

25 Q. Gentlemen, then I have one other

1 question pertaining to the Act, not pertaining to your
2 perception of the risk.

3 In your analysis of the costs of nuclear
4 power presented to this Board or presented to the
5 Select Committee have you evaluated the worth, if you
6 will, of the liability shield in the Act -- apart from
7 this question of whether or not the industry would
8 participate or not, have you evaluated what, if you
9 will, the expectation cost is of all nuclear risk or
10 what the insurance cost would be for insuring the
11 entire risk, which risk you in fact are shielded from?

12 MR. PENN: A. Well, I haven't
13 consciously done that. I don't even know what the
14 premium is to cover this to the extent of this
15 liability, but I presume whatever the premium is that
16 since it is a nuclear matter it is distributed over the
17 total cost of the existing nuclear generating system
18 and any addition to it.

19 Q. No, Mr. Penn. I was asking you if
20 you had evaluated -- in effect, I am asking you if you
21 had evaluated what the premium would be in the absence
22 of the Act so we can see what Hydro believes the risk
23 is in total.

24 A. Well, I have no knowledge of that
25 type of analysis, and I don't know whether it has ever

1 been done in the corporation. I just don't know.

2 [3:10 p.m.]

3 THE CHAIRMAN: Well, as my colleague, Dr.
4 Connell, points out, it's almost the same as the answer
5 to 11.7.27, dealing with avoided cost: Ontario Hydro
6 has no estimates of the impact of avoided cost if the
7 Nuclear Reliability Act was removed.

8 So I suppose in a sense that's an answer
9 to the question.

10 MR. D. POCH: Yes, thank you, Mr.
11 Chairman.

12 Thank you, Mr. Penn.

13 THE CHAIRMAN: I don't want Mr. Penn to
14 agree with that.

15 MR. PENN: I have no personal knowledge
16 of the matter, Mr. Chairman.

17 THE CHAIRMAN: All right.

18 MR. D. POCH: I will take that answer
19 then as the Chairman and Dr. Connell pointed out as
20 covering my question.

21 Q. Just before carrying on with the
22 questions of safety in the environment.

23 Mr. Johansen, I am interested in your
24 role. I recall a discussion you had wherein you
25 indicated that - I think your words were - planning

1 choices are dominated - that was your word - by the
2 system planners. I want to make sure I understand
3 that. Are you saying your role is simply to develop
4 profiles of each option, and it's the system planning
5 group that weights the various factors?

6 MR. JOHANSEN: A. That's basically true,
7 yes. They integrate it, that is.

8 Q. And any weighting that would go on,
9 any comparison that would go on would be done by them
10 if it's indeed done?

11 A. Yes.

12 Q. Okay. Turning to reactor safety.

13 Mr. King, you referred to four special
14 safety systems, the two fast shutdown systems, the
15 emergency coolant injection and containment. And you
16 noted the exception being Pickering "A" which doesn't
17 didn't have two independent fast shutdown systems.

18 Could you tell me what the reason for the
19 change after Pickering "A" was?

20 MR. KING: A. This decision would have
21 occurred, I guess we are talking early to mid 1970s. I
22 guess my impression of it, I wasn't involved at that
23 time, but my impression of it was that the dual failure
24 analysis requirement was in place at that time and
25 because of the speculative nature of doing a process

1 system failure with the loss of the single shutdown
2 system, that it was a preferable route to have the
3 second shutdown system, and not get into that more
4 speculative analysis that you would have to do to meet
5 the requirements of dual failure analysis.

6 Q. Can I interpret that as you didn't
7 have a sufficiently non-speculative analysis at the
8 time to demonstrate that you met the safety criteria
9 without such a second system and you judged it made
10 more sense to add to the second safety system then to
11 try and go through to shore up your analysis?

12 A. Like I say, I wasn't involved at that
13 time, I am just going from general knowledge. But I
14 think you are summary of what I said is fairly
15 accurate.

16 The role of the AECB at that time and
17 their motivations I am afraid I am not aware of that.
18 I think it was about 1977 when they issued a document
19 called R10, which is the regulatory document R10, which
20 formalized the requirements for two shutdown systems.

21 Q. Mr. King, could you turn up page 44
22 of Exhibit 519, your overheads. Perhaps I should ask
23 you, you indicated you do two safety analysis, one is
24 this deterministic analysis where you hypothesize
25 certain accident scenarios and then satisfy yourself

1 that you have sufficient systems in place to make the
2 probability of a serious consequence small enough to
3 meet the criteria that the AECB has indicated? Have I
4 got deterministic right?

5 A. The deterministic analysis refers to
6 the analysis that you have to do to meet the sighting
7 guide for all reactors except Darlington or the C6
8 requirements for Darlington.

9 Q. We will come to that in a minute.
10 And the other analysis you do is the probabilistic risk
11 study or probabilistic risk analysis which is in the
12 case of Darlington it's the DPSE?

13 A. That's correct.

14 Q. And in your DPSE, or your
15 probabilistic risk assessment do you consider scenarios
16 where you have simultaneous problems in different units
17 of the same station, or is it a unit, single unit
18 analysis?

19 A. It's primarily a single unit
20 analysis. I am just trying to recall if there is any
21 scenarios at all which involve some multi-unit
22 failures. I don't believe there is any.

23 Q. And looking at page 44, I interpret
24 it, and I think Mr. Penn agreed, that in the upper
25 right-hand corner, the accumulator water tanks, that's

1 part of the emergency cooling system?

2 A. For this particular reactor, yes.

3 Q. And if you look under those tanks you
4 will see "to other units". I take it from there that
5 at least part that have system then is common to more
6 than one unit?

7 A. That's correct.

8 Q. So your safety analysis then doesn't
9 consider possibility of perhaps some external event
10 initiating simultaneous accidents to two units in this
11 system being occupied by one and being unavailable for
12 the next?

13 A. This system, the emergency coolant
14 injection system is required following a loss of
15 coolant accident, and we do not consider loss of
16 coolant accidents happening at more than one reactor at
17 one time, that's correct.

18 Q. I am going to turn to Exhibit 528,
19 which was, I believe, an AECL-tabled exhibit. Yes.
20 It's entitled Comparison of CANDU Reactor, PWR and BWR.

21 MS. PATTERSON: What was the number
22 again, Mr. Poch?

23 MR. D. POCH: 528.

24 MR. KING: Yes, I have it.

25 MR. D. POCH: Q. If you would just turn

1 to the third page there is a picture at the top of a
2 CANDU reactor. The components marked "A" are the steam
3 generators?

4 MR. KING: A. That's correct.

5 Q. Is this an accurate depiction of the
6 location of the steam generators in your, that is
7 Ontario Hydro's newer CANDUs, post Pickering CANDUs?

8 A. No, it's not.

9 Q. Can you explain how it's inaccurate?
10 With respect to steam generators I am talking.

11 A. The difference between this depiction
12 and Darlington?

13 Q. Yes.

14 A. Okay. This is a reactor of the 600
15 megawatt Pickering "A" "B" type, a round what we call
16 cylindrical building. The Darlington and Bruce types
17 are of the square design.

18 The primary head of the steam generator,
19 in this particular drawing here it would be the dark
20 portion at the bottom of the steam generators. That
21 part of the steam generator would be within the
22 concrete part of the containment envelope. The upper
23 part where you see the "A", that part would be enclosed
24 within another structure above the concrete containment
25 envelope.

1 I am not sure if we have another picture
2 of that--

3 Q. That is fine.

4 A. --that has been presented already.
5 But it would be easier to describe if I had a picture
6 available.

7 Q. In essence, if I understand you
8 correctly, the steam generator passes through the
9 concrete containment structure and then there is some
10 steel structure around the part that it protrudes?

11 A. Yes. There was a change made in
12 going from the Pickering "B", going to the Bruce "A"
13 "B" design and maintained at Darlington, which went to
14 this containment concept primarily to remove certain
15 components from the reactor environment also to -- I
16 guess the primary reason is to reduce occupational
17 exposure to workers.

18 Q. Now, there was another point I just
19 wanted to clarify. There was a discussion about
20 negative and positive void coefficient and I wanted to
21 just get a few bottom line points here.

22 In a loss of coolant accident you have,
23 in effect, created a positive void?

24 A. That's correct.

25 Q. And the CANDU reactor has a positive

1 void coefficient which means in a loss of coolant
2 accident scenario reactivity goes up?

3 A. That's correct.

4 Q. And I understand your point that
5 other reactors have a parallel problem in the opposite
6 direct in different scenarios. But I just want to
7 understand that one of the features of nuclear reactors
8 then is that in some accident scenarios and in the case
9 of CANDU it's a loss of coolant scenario, the
10 reactivity actually goes up just when you have got a
11 problem keeping the fuel cooled.

12 A. It goes up until such time as it
13 reaches the level that initiates the shutdown systems
14 to operate to then terminate that increased power.

15 Q. Yes, okay. Now, I wanted to turn to
16 the question of monetization of accident risk. Panel 3
17 we had a question about this which led to an
18 undertaking.

19 If you refer to page 121 of our first
20 volume, you will see the undertaking there and the
21 answer.

22 Mr. Chairman, you may recall I tabled a
23 page from the Darlington probabilistic safety
24 evaluation which included Hydro's assessment of
25 accident consequence on an expectation basis on a cents

1 per kilowatthour as .1 to .2 cents, and they also
2 included a figure for the cost of Darlington as 10 to
3 20 cents per kilowatthour, and I asked for an
4 explanation. This was the explanation provided. This
5 is Exhibit 183.9.

6 Now, from your explanation, I take it
7 that the difference between the 3.1 cents per
8 kilowatthour mentioned there and the 10 to 20 cents in
9 the DPSE is that the 3.1 is LUEC and 10 to 20 is AUEC
10 in escalated dollars?

11 A. Yes.

12 Q. You don't say for what year. Do you
13 know what year the 10 to 20 would be for? Would that
14 be first year AUEC?

15 A. Well, the 10 to 20 came from -- I
16 guess we made a request at the time that the DSPE was
17 being prepared to system planning and somehow or other
18 there was a confusion in differences between LUECs and
19 TUECs between the two people who were communicating.
20 The time frame though that that 10 to 20 -- it
21 represented the approximately the mid-life of the
22 Darlington reactor. There was a curve we were
23 presented with.

24 Q. And of course we have heard how AUEC
25 or TUEC is front-end loaded.

1 I take it the .2 cents or the .1 cents
2 is, in essence, a level cost represents the risk per
3 kilowatthour, it wouldn't matter when, it would simply
4 rise with inflation over time. There is no capital
5 component that is accumulating interest or being
6 depreciated or anything of that nature?

7 A. Well, this .1 to .2 is just a product
8 of an accident frequency and these cost estimates. So
9 whatever the 10 to 20 represents, I guess the .1 to .2
10 represents, and it was an AUEC in error and that goes
11 up over time.

12 Q. It goes down over time, the AUEC, but
13 we don't need to settle that today.

14 A. Well, obviously I am probably getting
15 into cost areas which are beyond me.

16 Q. Could you just turn to page 123 of
17 our exhibit. This is page 91 of Exhibit 190 which is
18 the DPSE. This was the page that gave rise to our
19 question originally. Would you agree with me that the
20 mention of the 10 to 20 cents is there specifically as
21 a contrast to the accident risk number in the second
22 paragraph, and indeed, in the conclusions it reads:

23 The on-site economic risk as defined
24 in the DPSE is estimated to be \$10
25 million per reactor year. This value is

1 found to be small when compared to the
2 annual cost of power production.

3 A. You are right, the purpose of putting
4 in a number was to put the .1 to .2 number in
5 perspective.

6 Q. Of course, if you compared it to the
7 lower LUEC number, it would be in a somewhat different
8 perspective?

9 A. The accident that drives the .1 to .2
10 number in the DPSE was a loss of coolant accident, a
11 small loss of coolant accident which initiated the
12 emergency coolant injection system. There are no fuel
13 failures involved at all. The cost was a downgrading
14 of the heavy water and the cost of upgrading that heavy
15 water.

16 The frequency of that event was
17 conservatively assumed. If we were redoing that number
18 right now, given that we have six more years of
19 operation without having that event and we were
20 estimating frequencies based on having no previous
21 events at that time, these estimates would be lower
22 today.

23 Q. I am intrigued. So you say that the
24 operating experience, the reliability of systems
25 experience is a relevant consideration in such

1 assessments?

2 A. Where the experience data base has no
3 failures, no previous events, we have never had a loss
4 of coolant accident which required the ingestion of ECI
5 which is a light water system, then you have to make,
6 using some statistical techniques, an estimate of that
7 likelihood even though your past experience indicates
8 there were no such events. As you get more reactor
9 years of experience with no events, then the
10 statistical techniques that we would use recognize that
11 increased experience and the prediction would be lower.

12 Q. All right. We will come to this in a
13 minute.

14 Just so we can bring that number
15 up-to-date, the .1 or .2, it was compared to 3.1 cents
16 in '89 dollars.
17 [3:30 p.m.]

18 The .2 number, in fact, it is from 1985
19 when this study was done?

20 A. Well, the study was published in
21 December, '89. The year of the dollars that are being
22 referred to --

23 Q. Let me just help you here. I see at
24 the bottom of page 121 it says the 3.1 in '89 dollars
25 is 2.6 cents per kilowatthour in '85 dollars. I took

1 it that that translation was made so we could be in the
2 same basis as the .1 to .2?

3 A. Well, it would be my guess that the
4 dollars were within the years of 1985 to 1987. I'm not
5 sure which one.

6 Q. Will you accept it is '85, subject to
7 check, based on that? I will assume that.

8 So if we just wanted to update the 2.6
9 cents per kilowatthour in -- I'm sorry, if we wanted to
10 take the .2 estimate in '85 dollars we could just
11 escalate it then accordingly? It would be higher now?

12 A. Well, the .1 and .2 you are saying
13 today if we estimated that number?

14 Q. No, if we wanted to take that
15 estimate there is nothing wrong with me just taking
16 that estimate in '85 dollars and using an index to
17 inflate it to current dollars?

18 MR. PENN: A. Well, you would be right
19 if nothing else changed, Mr. Poch, but, as Mr. King has
20 explained, that since we have had another nearly seven
21 years of experience and we have never had the event,
22 then the .1 to .2 would be--

23 Q. Your assessment of the risk may
24 change?

25 A. --lower.

1 Q. Yes, I understand your point.

2 A. There would be an offsetting
3 situation, yes.

4 Q. Could you turn to page 124 of our
5 exhibit?

6 Mr. Chairman, this is from Exhibit 91 in
7 these proceedings, and this has been previously put
8 before you. This is where we reported Hydro's --

9 THE CHAIRMAN: Just let me be clear.
10 This is a document that has been created by you from
11 the data in '91 or this is actually from --

12 MR. D. POCH: No, this exhibit was made
13 Exhibit 91 in these proceedings. I don't know --

14 THE CHAIRMAN: It is your exhibit?

15 MR. D. POCH: It is our exhibit.

16 THE CHAIRMAN: I'm sorry.

17 MR. D. POCH: It was part of a study
18 comparing Hydro's estimates of externalities that were
19 presented to the National Energy Board--

20 THE CHAIRMAN: Oh, yes. All right.

21 MR. D. POCH: --with those of other
22 States and organizations, and I am just using it here
23 as a convenient place to find Hydro's estimates that
24 were put before the National Energy Board for nuclear,
25 and this is in cents per kilowatthour in Canadian 1989

1 the estimate of risk there is -- well, that the DPSE
2 estimate of risk is 200,000 per cent, by my
3 calculation, greater than the one --

4 A. I am not sure we are comparing the
5 risk of the same. I am not sure what the risk of this
6 is.

7 Q. All right.

8 A. Can you tell me?

9 Q. This is externalities. I took this
10 to be the risk. I assume this is the external risk,
11 the risk the public bears from the operation of nuclear
12 power plants?

13 A. The risk in the DPSC is an on-site
14 economic risk to Ontario Hydro; it is not an off-site
15 risk at all.

16 Q. From that, if we are right then, we
17 can conclude that Hydro evaluates the on-site risk as
18 roughly 200,000 times -- I'm sorry, it is roughly a
19 thousand times higher than the off-site risks?

20 MS. HARVIE: Mr. Chairman --

21 MR. KING: Well, I don't know what this
22 number is --

23 MR. D. POCH: Q. Well, leaving aside the
24 NEB estimates, is that your understanding of how Hydro
25 evaluates the risk, how you, the safety analyst,

1 evaluate the risk?

2 THE CHAIRMAN: Ms. Harvie is on her feet.

3 MR. D. POCH: Yes, Ms. Harvie?

4 MS. HARVIE: The witness has said he
5 doesn't know the basis of our estimates for the
6 National Energy Board, and so to conclude that they are
7 or to continue on with your question of the assumption
8 that they relate to external risks I think is mistaken.

9 MR. D. POCH: I won't base my question on
10 that then.

11 Q. Mr. King, can you just tell us what
12 is the comparable number for off-site risk, then? You
13 have given us the .1 to .2. Is my understanding
14 correct, then, that Hydro's assessment of the off-site
15 risk is much smaller orders of magnitude smaller?

16 MR. KING: A. Well, it is my judgment
17 that the off-site risk is smaller than the on-site
18 risk. I can't put an exact number on that, but my
19 judgment would be that the off-site risk is
20 considerably smaller than the on-site risk.

21 Q. And what do you include in that
22 category, off-site risk, in making your judgment today?

23 A. This would be the typical sort of
24 things which are calculated in the industry using the
25 various codes that have been developed for off-site

1 risk, which would include decontamination, relocation,
2 interdiction of land and farm produce.

3 Q. Health --

4 A. Various things like that.

5 Q. Health effects?

6 A. I believe when you do these
7 calculations you can include or not include health
8 effects as you can do with any of the parameters.

9 Q. Were you including that in your
10 judgment you gave me a moment ago?

11 A. I think my judgment would stay the
12 same whether you included health effects or not.

13 Q. Would it be fair to say that your
14 probabilistic risk assessment, anybody's probabilistic
15 risk assessment, is only as good as your ability to
16 think up what might go wrong and also only as good as
17 your assessment of the reliability of the various
18 components and systems?

19 A. Well, the whole purpose of
20 probabilistic risk assessment is to look at the future
21 by constructing models of what could possibly happen in
22 the future and by putting in data in those models,
23 where you have experience to use that experience, where
24 you don't have that experience you have to come up with
25 that data in other ways.

1 Q. So you would agree with my question -
2 you would agree with my hypothesis - that it is only as
3 good as --

4 A. The predictions are only as good as
5 the models and the data you use.

6 Q. Right.

7 A. Which is the case for any predictive
8 model.

9 Q. Right. And your model -- and one of
10 the parameters is the -- if we were to try to
11 objectively -- if we were all knowing and we were
12 trying to judge the value of a PRA one of the tests
13 would be: Have they thought of everything that might
14 go wrong and assign some probability to it, first of
15 all - the extent, if you will, of the considerations in
16 the model? Would you agree with me that is one factor?

17 A. Yes. Generally, yes.

18 Q. And then in the assignment of a
19 probability to a part of an accident sequence -- I have
20 used the word "probability". In fact, what you would
21 assign is either a reliability factor to a system or an
22 expectation number to some event occurring, some
23 failure?

24 A. Well, depending on what part of the
25 model you are trying to quantify there are various ways

1 to input the numerics into it. In a -- sometimes --
2 well...

3 Q. And again, the result of the model,
4 the value of that result is, of course, contingent upon
5 how good a judgment you have made of those
6 reliabilities?

7 You spoke to that a moment ago?

8 A. And that is the case with any
9 predictive model.

10 Q. Yes. Now, it is true that reality
11 isn't always as pretty as studies predict? I guess
12 that is a truism. But with that thought in mind I
13 wanted to take a look at how things have been going,
14 and I will do this by reference to examples reported in
15 Exhibit 525, Mr. Chairman. This is the report entitled
16 Nuclear Power: Hazard Report, 1989/1990.

17 A. Yes, I have it.

18 MR. D. POCH: And we referred to this
19 earlier, and it is the report where we have compiled a
20 number of statistics and descriptions of events and so
21 on that were obtained from review of various Hydro and
22 AECEB publications.

23 THE CHAIRMAN: Are you going to deal with
24 this extensively?

25 MR. D. POCH: Yes, Mr. Chairman.

1 THE CHAIRMAN: Well, then perhaps we
2 should take a break before we get into it. We will
3 break for 15 minutes.

4 THE REGISTRAR: Please come to order.
5 This hearing will recess for 15 minutes.

6 ---Recess at 3:40 p.m.

7 ---On resuming at 4:00 p.m.

8 THE REGISTRAR: Please come to order.
9 This hearing is again in session. Be seated, please.

10 MR. D. POCH: Mr. Chairman, I am joined
11 by Ms. Irene Kock, who is the researcher who helped
12 pull this material together.

13 Q. Mr. King, perhaps we could start on
14 page 3 of Exhibit 525, and we are going to be looking
15 at some information gleaned from your SERs, your
16 Significant Event Reports, during 1989 and 1990.

17 I understand from this material there
18 were 1,387 SERs in that time frame. Does that sound
19 about right?

20 MR. KING: A. In my evidence in chief I
21 think I referred to 600 to 700 a year for all stations,
22 so it looks about right.

23 Q. And you are required by the AECB to
24 report more serious accidents under conditions of your
25 operating licenses for the various nuclear stations?

1 A. There are criteria in the accident --
2 in the licenses which require us to do so, yes.

3 Q. And the indication here that there
4 were 269 such reportable events or roughly 20 per cent
5 of all significant events --

6 A. Sorry, where are you reading right
7 now?

8 Q. This is in the second paragraph under
9 Reportable Events.

10 A. Okay, I have it.

11 Q. Does that accord with your
12 understanding?

13 A. I haven't checked that number, but I
14 have no reason to believe it to be inaccurate.

15 Q. If we were to go to the following
16 page, page 4, we had a sort done, and our sort
17 indicates as expressed in figure 1A that 48 per cent of
18 the significant event consequences were an effect on
19 safety systems. We have called it a 'compromise', and
20 I don't want to put that word in front of you because I
21 am afraid it will just provoke an argument, but would
22 you agree that roughly half of the significant events
23 affect the safety systems?

24 A. Well, I believe you have given in one
25 of the appendices the classification system. Just let

1 me check.

2 THE CHAIRMAN: I'm sorry, what period
3 does this significant event pie relate to?

4 MR. D. POCH: This is the two years
5 covered, '89 and '90, Mr. Chairman.

6 THE CHAIRMAN: Calendar '89 and '90?

7 MR. D. POCH: I'm sorry, Mr. Chairman?

8 THE CHAIRMAN: Calendar '89/90?

9 MR. D. POCH: Yes, that's correct, Mr.
10 Chairman.

11 MR. KING: The categories that you have
12 here -- I am just looking, comparing your pie chart on
13 page 4 to the Hydro classification system on page 48 of
14 the document.

15 MR. D. POCH: Q. Yes?

16 MR. KING: A. I assume that there is a
17 one-to-one relationship in the categories here?

18 Q. Yes, the --

19 A. So you did the sort based on which
20 category?

21 Q. Category 6: Safety or protective
22 system fault. First digit under Consequence.

23 A. Okay. And you are suggesting that
24 under that sort on the sixth -- consequence digit 6 you
25 came up with 48 per cent of all -- is it the reportable

1 events or all the SER's?

2 MS. KOCK: -All the SERs.

3 MR. D. POCH: Q. All the SERs, yes.

4 It is explained in the text, Mr. King, if
5 I can help here, that we sorted all the SERs that were
6 reported where the codes were reported. Apparently,
7 there was a brief period of time when a different code
8 system was used. Then you reverted back. We just took
9 the ones that fell into this four-digit code.

10 MR. KING: A. But a thousandth of the
11 events were not reportable to the AECB, but you have
12 included those in coming up with this pie chart?

13 Q. Yes, that is correct. These are all
14 of the significant event consequences. And does this
15 accord with your understanding of the -- obviously, I
16 can't expect you to agree with the precise number.

17 A. So if it was a fault -- well, if you
18 have done the calculation. I haven't done the
19 calculation. You have done the sort.

20 Q. It doesn't strike you as unlikely
21 that roughly half of the SERs are category 6?

22 A. As you say, it doesn't overly
23 surprise me if it turned out that way.

24 Q. That is sufficient, Mr. King, for my
25 purposes. You are familiar with the typing categories

1 that Hydro applies to safety system faults or failures?

2 There is the type 0 through type 5.

3 A. Just on that pie chart, I would just
4 like to state that I don't agree with the term
5 "compromise" of safety systems. As you acknowledge,
6 that is your term not --

7 Q. Yes, and I take it you would be more
8 comfortable with the term "affecting"?

9 A. Well, I would be more comfortable
10 with the names for all the categories, actually, on
11 that pie chart as they are represented in Hydro's
12 Significant Event Report system.

13 Q. Let's just say that that category is
14 for the type 6 ones then as defined in the appendix.

15 Now, you are familiar with the typing of
16 these faults?

17 A. Yes.

18 Q. And you would agree that a type 0
19 fault - the definition of a type 0 fault - is a fault
20 which totally incapacitated a special safety system
21 such that it would not have provided any protection
22 under any conditions?

23 A. Let me just get my definitions.

24 Q. Sure.

25 A. Okay. I have them now.

1 Q. The type 0 special safety system
2 fault would be one where a fault totally incapacitated
3 a special safety system such that it would not have
4 provided any protection under any conditions?

5 A. That is the definition.

6 Q. And that is type 0. And type 1 would
7 have been a fault which significantly reduced the
8 effectiveness of a special safety system such that it
9 would have been of little or no benefit if the worst
10 possible process system failure had occurred?

11 [4:10 p.m.]

12 A. That's the definition.

13 Q. And we will get to what process
14 system failure is.

15 I take it process system is the ordinary
16 systems of the reactors. The failure of which
17 presumably would be the initiator of an accident
18 sequence?

19 A. That's correct.

20 Q. And type two special safety system
21 faults result in a reduction of the effectiveness of a
22 special safety system such that the system is unable to
23 satisfy its overall design intent and the system,
24 however, would still have operated and some significant
25 benefit would have been gained from its operation?

1 A. That's the definition.

2 Q. And it is those three types that are
3 included in the reportable event category; is that
4 right?

5 A. I believe so.

6 Q. So that 269 reportable events over
7 those two years all involved safety system faults of
8 type zero, one or two?

9 THE CHAIRMAN: I'm sorry, what was that
10 again?

11 MR. D. POCH: The 269 --

12 MR. KING: I believe your 48 represented
13 the 1,300. Wasn't that...

14 MR. D. POCH: Q. I am sorry, would you
15 repeat that?

16 MR. KING: A.. That pie chart has 48 per
17 cent of significance events. I thought you said the 48
18 per cent was related to all the SERs, not the
19 reportable SERs.

20 Q. Yes, I'm sorry. Let me be clear.

21 Let me ask you, rather than put it that
22 way.

23 THE CHAIRMAN: I am a little confused
24 because the second pie chart, 1B, shows type zero, type
25 one and type two as adding up to 9 per cent, which is a

1 lot less than the 20 per cent figure that was
2 previously stated.

3 MR. D. POCH: Yes.

4 THE CHAIRMAN: So I am little confused by
5 what we are doing here.

6 MR. D. POCH: Let me rephrase my
7 question.

8 Q. Among the reportable events, you are
9 required to include in that category all type zero, one
10 or two safety system failures amongst other?

11 MR. KING: A. Yes, I believe so.

12 Q. I'm sorry if I reversed that.

13 And as is apparent from the chart the
14 Chairman just pointed to, there were no type zero
15 events in those two years, were there?

16 A. Well, you haven't plotted any on
17 figure 1B.

18 Q. Are you aware of any that we missed?

19 A. No, I am not.

20 Q. There have been type zero faults in
21 the past?

22 A. I don't believe right now the type
23 zero category is really in use. The type one really
24 says it has little or no benefit, so type zero really
25 isn't really isn't much worse than type one.

1 Q. So these would tend to be categorized
2 as type one or type two, or beyond.

3 A. There is no difference if it's type
4 one or type zero.

5 Q. Okay, that was helpful.

6 And there certainly have been type one
7 events and indeed there were type one events in this
8 two-year time frame.

9 I understand you track the length of time
10 that special safety systems are not able to operate as
11 designed and that is referred to in the first full
12 paragraph on page 8 of this report.

13 A. Yes, and I discussed the process in
14 my direct evidence.

15 Q. And unavailability is a fraction of
16 time that a passive safety related system is impaired
17 such that it will not satisfy the design intent.

18 A. Yes. Dormant is the word we use
19 rather than passive. Dormant meaning it is not
20 normally running.

21 Q. I understand. So then any type zero,
22 one or two fault would find its way into your
23 unavailability statistic?

24 A. Yes, I believe so.

25 Q. And you indeed have targets for

1 unavailability, we have heard about them, they have
2 been referred to as 10 to the minus three and three
3 times 10 to the minus three, three times 10 to the
4 minus three being for Pickering "A"?

5 A. That's correct.

6 Q. And that is roughly eight hours for
7 all the stations except Pickering "A", eight hours per
8 year unavailability target and 26 hours, 24, 26 hours
9 for Pickering "A"?

10 A. Yes. I used 24 in my direct
11 evidence. Your 26 is more accurate. I was rounding it
12 off.

13 Q. I have a hunch you are probably right
14 about where the derivation of it came from. I chose 24
15 because it was a day and that just happens to round out
16 at three times 10 to the minus three, but it needn't
17 matter to us?

18 Your design intent is the basis for your
19 licensing, and your licensing - let me finish then -
20 and you are licensing creates these targets on the
21 understanding that of course you can't meet design
22 intent all the time; is that fair?

23 A. Yes. The target allows that the
24 systems, recognizes the fact that the systems could be
25 unavailable for periods of time.

1 Q. That target, I take it, is related to
2 the AECB's expectations for risk. For example, you
3 showed us a table that is used for the deterministic
4 analysis where they have certain categories and they
5 put a bound on what the probability of those events
6 are. And I take it that, at time of licensing, in
7 satisfying those criteria you show that you will meet
8 those criteria assuming that the design intent is met
9 or is not exceeded more than these 10 to the minus
10 three or three times 10 to the minus three figures
11 amount; is that fair?

12 A. You were referring to the C6 table?

13 Q. Yes.

14 A. The classification of all the design
15 basis events which used the frequency criteria which
16 was in the C6 table, some of them where it comes in the
17 dual failure case would recognize that the special
18 safety system targets existed, yes.

19 Q. It would be consistent with -- those
20 targets are, in effect, statements of what the
21 expectation was and is assumed to be for purposes of
22 that analysis?

23 A. But it's not a given that if the
24 unavailability targets were not met that you would
25 clarify the event any differently, because it's a

1 feature of both the initiating event frequency and the
2 dual failure analysis situation, the probability of
3 failure of the special safety system.

4 Q. Just so I understand what your last
5 point is, that, for example, in the probabilistic a
6 risk assessment, if we were looking at a posited
7 sequence of events, the probability of this ultimate
8 consequence coming to be is the product of the
9 probabilities of each failure that in turn would have
10 to occur for that consequence to occur?

11 A. No. What I was referring to is in
12 the C6 there are five classes of accidents. Class 5
13 is -- perhaps I should refer to the Exhibit 519.

14 Q. Yes. This is at page 40 and 41,
15 Exhibit 519.

16 A. Page 40. So if you had an accident,
17 a single accident, or a process system failure, let's
18 say it was classified as event Class 4, and that
19 process system failure, let's say a large loss of
20 coolant accident, if that was in event Class 4, and you
21 would say where should a large loss of coolant accident
22 and failure of the emergency coolant injection system,
23 where would that be classified, and then you would look
24 at the reliability of the emergency coolant injection
25 system, the target being 10 to the minus three, and

1 that would indicate it should be in Class 5.

2 Q. Yes.

3 A. But, it also should be in Class 5 if
4 ECI unavailability was 10 to the minus one or 10 to the
5 minus two as well. So that is the point I was trying
6 to make.

7 Q. That is fine.

8 And just so we understand, that was with
9 respect to the deterministic analysis. And in the
10 probabilistic analysis then --

11 THE CHAIRMAN: I didn't understand any of
12 that.

13 Let's start with what do you mean by
14 Class 4? I am looking at page 40?

15 MR. KING: Yes. Sorry, Mr. Chairman.

16 THE CHAIRMAN: 519. Is that what I am
17 supposed to be looking at?

18 MR. KING: Yes.

19 THE CHAIRMAN: You talked about Class 4,
20 what do you mean by Class 4?

21 MR. KING: On the left-hand column there
22 is...

23 THE CHAIRMAN: Very low probability
24 postulated failure?

25 MR. KING: That's right. And if you look

1 at third column you have a long list of design basis
2 accidents, and then you have to classify them into one
3 of those five event classes in order to determine what
4 is the individual dose limit that you would use to look
5 at the acceptability of your deterministic safety
6 analysis.

7 THE CHAIRMAN: Right.

8 MR. KING: So when you do that
9 classification, and I was using for an example, let's
10 say there was an event which had a process system
11 failure, a large loss of coolant accident with a
12 frequency of 10 to the minus four.

13 THE CHAIRMAN: That is a Class 4 event.

14 MR. KING: Then you would put that in
15 event Class 4.

16 THE CHAIRMAN: And you do that because of
17 the third column; is that right?

18 MR. KING: Well, the second and third
19 columns, one is in numerical terms and the other one
20 was just an attempt to try to say it in more common
21 understood terms. But when you get into the very low
22 probabilities it's pretty hard to express those in
23 common terms. That's why it is just low, very low and
24 extremely low.

25 THE CHAIRMAN: So you had an accident you

1 just described and you classified it as Class 4.

2 MR. KING: And then when the people doing
3 the deterministic safety analysis as reported in the
4 safety report, if they did that analysis and they would
5 predict with a set of conservative assumptions that you
6 would use in deterministic safety analysis, they would
7 predict what the whole body and thyroid dose to the
8 individual on the boundary would be, then they would
9 compare it to those predictions to the fourth and fifth
10 columns, and in particular it would be 0.10 sieverts
11 whole body, or 1.0 sieverts thyroid, to see if their
12 prediction of consequences were acceptable from an AECB
13 criteria point of view.

14 THE CHAIRMAN: All right.

15 MR. KING: Then what else I was
16 mentioning is that you would also have to look at the
17 dual failure and that is this large loss of coolant
18 accident combined with an assumed failure of the
19 emergency coolant injection system. That combined
20 failure is of lesser probability, and that would fall
21 in event Class 5.

22 The point I was trying to make is that it
23 would fall in event Class 5 whether the ECI system had
24 an unavailability of 10 to the minus three or 10 to the
25 minus two or 10 to the minus one. Well, if it was 10

1 to the minus one you may want to put it in Class 4. If
2 it was 10 to the minus two or 10 to the minus three it
3 would be in Class 5.

4 MR. D. POCH: Q. Mr. King, while we are
5 on this, the converse is true then. If you postulate a
6 sequence of events which results in a consequence where
7 the individual dose limit is of a given amount, you
8 could then work backwards, couldn't you? You could
9 say, if this accident sequence has this consequence,
10 the AECB is telling me I must put in place enough
11 layers or have enough assurance of reliability of my
12 system so I can satisfy them that for, say, a whole
13 body dose of .1 sieverts, that the probability of that
14 chain of events occurring will be between 10 to minus
15 the four and 10 to the minus five or better?

16 MR. KING: A. Theoretically that is
17 correct, but in practice what normally happens is the
18 reverse because you analyze the event and you are
19 normally much below the limits.

20 Q. The probabilistic risk analysis makes
21 assumptions about reliability of systems as well, I
22 take it, in its effort to try to place probabilities on
23 different consequence events?

24 A. It makes predictions on reliability
25 rather than assumptions.

1 Q. All right. And so I think you have
2 already agreed with me that the record, as the example
3 you gave, it's been six or seven years since you did
4 the DPSE and there hasn't been a major accident and
5 therefore you might evaluate, you might change your
6 prediction of what the reliability of some systems are
7 based on that track record.

8 A. I was just referring to the case of a
9 loss of coolant accident which required ECI and caused
10 a downgrading of the heat transport system.

11 Q. But you agree with my interpretation
12 of what you have said, that you would be cognizant, it
13 would be appropriate to be cognizant of the track
14 record as it unfolds to go back and revisit your
15 predictions of reliability, what have you, in the
16 probabilistic risk analysis?

17 A. You want to use your best data which
18 reflects your performance in making future predictions.

19 Q. Right. And so in that light we could
20 look at such unavailability.

21 The examples that have arisen in the '89
22 and '90 period start at page 8 of Exhibit 525.

23 A. Yes, I have it.

24 Q. And the first example given is for an
25 emergency core, cooling unavailability, this was a hole

1 in the moderator purification room, and this was
2 categorized as a type one impairment?

3 A. I believe so. It was considered to
4 be an unavailability of emergency coolant injection.

5 Q. Right. And then in 1990 - that was
6 in '89 - in 1990 there was a type two fault -- I'm
7 sorry. First of all that type one fault was from early
8 '88, it lasted from early '88 to March of 1989?
9 [4:30 p.m.]

10 A. I forget the exact dates. What it
11 was was following the retubing of unit 2 there is a
12 penetration through the bottom of the wall of the
13 moderator room which should have had a blank on it, a
14 pipe penetration, and construction forces did not put
15 that blank in place.

16 Q. And it lasted for something over a
17 year in that condition?

18 A. That sounds about right.

19 Q. Right. And it was found to be a type
20 one impairment?

21 A. That's correct.

22 Q. All right. So just looking at that -
23 it is Pickering "A" - you are allowed three times 10 to
24 the minus three for ECI unavailability, or, on average,
25 one day a year; that year you had 365 days? Have I got

1 the relationship right?

2 A. Yes, that was a significant
3 unavailability. For some loss of coolant accidents
4 that would have led to water entering the moderator
5 room, and the concern was flooding of the moderator
6 pumps which are used not in the initial phases, but, as
7 I described, there are a number of phase of ECI
8 injection, and it is the recovery from the floor in the
9 longer term.

10 Q. Yes. And then there was a type two
11 fault in November of 1990 which was found to have been
12 the case for the previous 11 months? And that was at
13 Pickering Unit 4?

14 A. Well, this event is not accurately
15 described here.

16 Q. Perhaps you can tell us about it.

17 A. It is not the moderator pumps in that
18 room. There are two sump pumps in the room. There are
19 five moderator pumps which are used for ECI recovery,
20 and just like in any kind of room where you have pumps
21 around pumping water there can be leaks through glands.

22 And there is a pit in that room, and in
23 the case that you do get some water leaking from pump
24 glands that collects in a pit there are two small sump
25 pumps that remove that water and in fact put it back

1 into the moderator discharge line.

2 And what's the event here is in the ECI
3 reliability model we assume that there is some
4 possibility of having water leakage into the room, and
5 if those sump pumps are not available then that
6 potentially jeopardizes the moderator pumps themselves.

7 Q. All right. So it is correct in that
8 the moderator room pumps were potentially in jeopardy,
9 but it was actually due to the unavailability of a--

10 A. What's called a sump pump.

11 Q. --sump pump which sits with them to
12 protect them in effect?

13 DR. CONNELL: The number is two - two, is
14 that correct?

15 MR. KING: There are two sump pumps.
16 They weren't in the reliability model until fairly
17 recently when it was decided that -- just to allow for
18 the fact that there could be some water coming into
19 that, into the sump from potentially moderator pump
20 gland leakage and potentially other sources, that they
21 were put in the model.

22 The testing frequency was fairly long at
23 that point in time. The testing frequency has been
24 increased substantially. As well, the pumps have been
25 completely, not fully replaced but most of the

1 components of those pumps have been replaced to --

2 MR. D. POCH: Q. Dr. Connell I think
3 asked the question: There are two pumps, two sump
4 pumps?

5 MR. KING: A. Yes, there are.

6 Q. In fact, both of them tripped out on
7 that occasion; is that not correct?

8 A. On operation their shafts seized,
9 yes.

10 Q. On both of them?

11 A. Yes.

12 DR. CONNELL: So if you were editing this
13 paper you would delete 'all moderator room pumps' and
14 substitute 'two small sump pumps'?

15 MR. KING: Both moderator room sump
16 pumps.

17 DR. CONNELL: Both?

18 MR. D. POCH: Q. Both moderator room
19 sump pumps? Okay.

20 MR. KING: A. And the last sentence, the
21 pumps would not have performed their crucial function
22 of recirculating the water to the ECIS, that would be
23 incorrect as well because the sump pumps don't perform
24 that role.

25 Q. What their function is is to protect

1 the pumps that recirculate the water?

2 A. That's correct.

3 Q. So perhaps that should read: not
4 have performed their function of protecting the pumps
5 that recirculate the water?

6 A. Given that there is a significant
7 leakage of collection of water in that moderator room.

8 Q. Yes. And, of course, those moderator
9 recirculation pumps, they would be particularly
10 important when there is a coolant loss, and, in fact,
11 that is just when you would have spillage?

12 A. Well, the moderator room is a
13 separate room. It isn't open to the normal environment
14 of the reactor building.

15 Q. But I have understood the need for
16 these pumps correctly; right? It is precisely when
17 there is water spilling out of the reactor?

18 A. Yes, they have a pipe going into
19 their suction from a sump which is not in the moderator
20 room; it is in the reactor building, the open area of
21 the reactor building where water would collect from the
22 loss of coolant accident.

23 Q. And if we drop down to the next
24 safety system, containment, I understand there was a
25 type two fault that you spoke of, I believe, in your

1 evidence-in-chief, pressure relief duct failed at
2 pressure below its design intent, and I understand that
3 according to this document that in fact it was
4 estimated - and I assume it can only be estimated -
5 that the containment, to the extent it was impaired by
6 that fault, had been impaired for 7-1/2 years prior
7 because of that problem; is that your understanding?

8 A. The event was a failure of not the
9 pressure relief duct. I think as I explained in my
10 direct evidence the duct is a --

11 Q. I'm sorry, I missed the words here:
12 a seal on the pressure relief duct?

13 A. Right. There is an expansion joint
14 and there is a rubber seal in it, and that is what
15 failed.

16 Q. Sure. And that is -- the 7-1/2 year
17 figure is what I was asking about.

18 A. And how you calculate the duration of
19 time is generally look back to see when you last tested
20 it to its design pressure and then make some guess,
21 but -- not guess, but some estimate of that time where
22 it could have been in that state where if you would
23 have reached the design pressure it would have failed
24 in the same manner. And yes, that time of
25 approximately seven years has been considered in

1 communications with the AECB.

2 Q. Right. And, in fact, the report goes
3 on to note that the AECB is asking you to find better
4 replacement seals than the ones you have for the long
5 haul, and you are working on that now; is that right?

6 A. Yes. They will likely be replaced
7 with a double seal which will allow some testing on a
8 more frequent basis. See, they are normally tested --
9 why it was tested in this period of time, it was the --
10 I guess it was the vacuum building outage.

11 DR. CONNELL: What does this duct
12 connect, Mr. King?

13 MR. KING: The eight reactor buildings of
14 Pickering each connect to this duct.

15 DR. CONNELL: Right.

16 MR. KING: And then it -- above-ground
17 duct, and it goes along the whole site for quite a long
18 distance, and then it connects at each point. Every
19 time you get to a reactor building it connects, and
20 then it connects on the other side to the vacuum
21 building.

22 So there are barriers between the reactor
23 buildings and the duct, and there is barriers between
24 the duct and the vacuum building which are normally in
25 place, but when you have an accident in one reactor

1 building then these barriers open, and then you have
2 the connection between the vacuum building and the
3 accident and reactor building.

4 DR. CONNELL: And what is the pressure
5 that is relieved? Is that the pressure in case the
6 system is activated?

7 MR. KING: The accident pressure
8 following a discharge of hot water and steam in the
9 reactor building increases the pressure of the reactor
10 building.

11 There are some relief panels separating
12 the reactor building and the duct. They will below
13 open. Now the duct is pressurized, and when the duct
14 is pressurized, as I think I mentioned in my direct
15 evidence, if it is a loss of coolant accident, if it is
16 a large loss of coolant accident from the heat
17 transport system, I believe the maximum pressure is --
18 I am just referring to my direct evidence. It is 14
19 kPa gauge or 2 psig in the pressure relief duct.

20 The design pressure of the pressure
21 relief duct is 42 kPa, kiloPascals gauge, or 6 psig,
22 and the seal failed at approximately 22 -- when the
23 duct was pressurized to 22 kPa or 3.2 psig.

24 As I mentioned in my direct evidence, the
25 design pressure of the duct is not set by the large --

1 the loss of coolant accident; it is set by the steam
2 main failure, because in Pickering the steam mains are
3 within containment, or part of them are within
4 containment.

5 MR. D. POCH: Q. And the other example
6 offered under Containment Deficiencies during that
7 two-year period was a nine-week long impairment of the
8 Bruce "B" containment system due to an improperly set
9 calibration of radioactivity monitors, and these were
10 monitors which would have tripped the isolation system
11 so there would have been some delay in the trip of that
12 isolation system, and that was therefore categorized as
13 a type two fault; is that correct?

14 MR. KING: A. Yes. I believe there are
15 two ways of getting automatic isolation. They will
16 automatically isolate on high activity as detected by
17 these monitors that are being talked about or high
18 pressure, or they can be isolated manually from the
19 control room. And one of those methods of isolating
20 failed, as indicated here.

21 Q. All right. And, in fact, Mr. King,
22 in many cases you have systems that overlap or are
23 redundant, and you take credit for that in your
24 probabilistic risk assessment, and you make estimates
25 of the reliability of each system, and the estimate of

1 the probability of a consequence for a given chain of
2 events is, as I said earlier, the product of each
3 subprobability, if you will. That's fair?

4 A. No, it's not. That is not the way we
5 calculate it.

6 Q. All right.

7 A. That would assume independence
8 between all of the subsystems. We in fact do an
9 integration of all our large fault tree models for each
10 of the systems that you would credit in a sequence to
11 make sure that there isn't any dependencies between the
12 initiating event and any of the mitigating systems or
13 any of the -- or within the mitigating systems. So it
14 isn't a straight multiplication of probabilities.

15 Q. Where you have independent systems it
16 would be a straight multiplication, and where they are
17 not independent then obviously you couldn't take credit
18 for duplication in all circumstances. That is what you
19 are saying?

20 A. Well, one of the purposes, and one of
21 the important purposes of the risk assessment process,
22 is to search for dependencies between initiating events
23 and mitigating systems and within mitigating systems,
24 and that is specifically why we go through this very
25 involved process of fault tree integration, to

1 determine that.

2 Q. All right. And finally, in the
3 category of fast shutdown system faults, here is an
4 example where both fast shutdown systems were
5 unavailable on Bruce unit 6 for one week in 1989 to the
6 extent of being categorized as a type two impairment?
7 And that is an example of what I could -- would it be
8 fair to call that a common mode problem affecting more
9 than one safety system?

10 A. I must admit I can't speak to the
11 details of this particular incident, but if both
12 systems were unavailable for the same cause that would
13 be an example of a common cause situation.

14 Q. All right. Now, those were all
15 examples of special safety system faults of types one
16 or two, considered serious enough to be reportable to
17 the AECB in that two-year period.

18 I take it, though, that accidents aren't
19 caused by special safety system faults. They would
20 just be more serious because of that, and generally one
21 would assume the initiator of an accident would be a
22 process system fault?

23 A. That is correct.

24 Q. And you type process system faults
25 into type A and B faults? And this is referred to on

1 page 11 of the report?

2 A. Yes, we do.

3 Q. And type A is the type which where
4 the failure of equipment or procedure leads to
5 significant fuel failure, and type B is the type where
6 in the absence of special safety system action the
7 failure could lead to such fuel failure?

8 A. Yes.

9 Q. All right. And then there are
10 lower -- lesser types C, D and E faults where there is
11 no risk of fuel damage? And I understand there were
12 four type B failures in 1989 and '90?

13 A. I can't confirm that number.

14 Q. All right. We can just look at these
15 quickly. I understand there was a type B fault on July
16 28th, '89, a loss of regulation?

17 A. Sorry, where are you reading?

18 [4:50 p.m.]

19 Q. I am reading from Section 1.3.2,
20 bottom of page 11. I have a hunch you have got your
21 SER binders there. It's 89-80, is the SER number
22 reference.

23 This was a situation where someone pulled
24 a fuse without recognizing that it took away power to
25 In-core flux detectors. Can you confirm that?

1 A. I see the reference.

2 Q. I'm sorry?

3 A. I see where you are reading, yes.

4 Q. Can you confirm that?

5 A. I will confirm that, subject to
6 check.

7 Q. All right. I actually have the SER
8 in front of me. I will just read a section to you for
9 comment, if I may. This is in the follow-up report at
10 page 15 and it says -- first of all, I take it that
11 when this occurred, you can take this subject to check,
12 the computerized reactor regulation system read the
13 situation as a drop in reactor power and responded by
14 raising power. This is called an unrequested power
15 increase?

16 A. That would be classified as a loss of
17 regulation.

18 Q. All right. And I noticed at page 15
19 of the follow-up report that it says:

20 At least five unrequested power
21 increases have occurred from RTD power
22 supply voltage failing load.

23 Could you tell me what RTD is, do you
24 know?

25 A. It's the end element of a temperature

1 detector.

2 Q. Okay. And it goes on to say:

3 There have been at least three
4 unrequested power increases on
5 individual Hilborn failure.

6 Could you tell me what Hilborn is? Is
7 that another type of detector?

8 A. Yes, it is.

9 Q. And that's the references that I
10 referred to here as in Exhibit 525 where it says the
11 follow-up report notes several other unrequested power
12 increases have incurred in the past.

13 There was also in 1989 another type B
14 event that we found in the records of what was called a
15 core blast. You might want to advise your people to
16 choose their nomenclature more carefully. It's in fact
17 a failure of the computer memory.

18 A. That's right.

19 Q. And this resulted in the computer, in
20 effect, the program with the trip limits and set points
21 in the program in effect resetting themselves; is that
22 correct?

23 A. Yes. The reactor was shut down, in a
24 guaranteed shutdown state, which means it was in a
25 fully over-poisoned state. There was no chance that

1 reactivity could have increased in this state.

2 Q. How fortunate.

3 And that was a type B event as well?

4 A. Well, I will again confirm that
5 subject to check.

6 Q. All right. And a further type B
7 fault noted as - we categorized as a loss of coolant
8 accident, again a software problem, an error in fuel
9 handling software instructed the wrong fueling machine
10 support or bridge to move down and, in essence, left
11 the machine hanging on the end of a fuel channel rather
12 than supported by its bridge and it caused a leak of
13 1,400 kilograms of heavy water per hour.

14 That was a type B fault.

15 Now, that was an accident involving
16 obviously a loss of coolant. Is that called a loss of
17 coolant accident, or LOCA?

18 A. Well, it is a very small loss of
19 coolant accident.

20 Q. All right.

21 A. We wouldn't consider it a massive
22 heavy water leak.

23 Q. How fast does water have to leak
24 before it gets to be a large loss of coolant accident?

25 A. Well, 1,400 kilograms per hour, if

1 you look at that in kilograms per second, which is the
2 normal way we look at it, that's I think .39 kilograms
3 per second.

4 If you go to the Darlington safety report
5 and look up a large loss of coolant accident, and
6 particularly I am thinking of 100 per cent pump suction
7 header break at Darlington, the initial discharge rate,
8 whereas this one was .39 kilograms per second, a large
9 pump suction break at Darlington would be 34,800
10 kilograms per second.

11 Q. All right. That's an example of a
12 very large loss of coolant, I take it.

13 A. That's large.

14 Q. And there is quite a lot in between.

15 Is there a line somewhere?

16 A. In safety analysis it varies from
17 station to station what is called a very small or
18 small, but there is no hard line.

19 Q. All right.

20 And another which occurred in 1990 was a
21 severe flux tilt at Pickering Unit 2. I am sure you
22 are familiar with this, Mr. King.

23 A. Yes.

24 Q. In fact, station management were
25 reprimanded by the AECB for not shutting down the

1 reactor right away, instead they tried to ride out the
2 transient, spent two days doing that?

3 A. I guess the important lesson learned
4 from that event is related to what you are talking
5 about.

6 Q. Could you answer my question? In
7 fact the AECB felt strongly enough about this that they
8 reprimanded station staff.

9 A. I am not sure of the word -- they
10 weren't happy with the situation.

11 Q. All right.

12 A. It was to do with the whole subject
13 of conservative decision-making and operation. I am
14 sure you read about that.

15 Q. Yes, we had some discussion about
16 that when you were describing in detail what happened
17 at Chernobyl. I recall that discussion.

18 Mr. Chairman, I am not exactly changing
19 topics, but I am moving on to another item.

20 THE CHAIRMAN: It is almost exactly five
21 o'clock, so we should probably stop for the day.

22 Have you got any rough idea how much
23 longer you are going to be, Mr. Poch?

24 MR. D. POCH: I will certainly be another
25 day, Mr. Chairman. I understand that Energy Probe

1 would likely take, they are estimating three or three
2 and a half days next week. So I will certainly be on
3 standby as the week progresses to come back on, and I
4 would estimate that between the two of us we will take
5 up next week.

6 THE CHAIRMAN: All right. We will
7 adjourn until Monday morning at ten o'clock.

8 THE REGISTRAR: This hearing will adjourn
9 until morning next at ten o'clock.

10 ---Whereupon the hearing was adjourned at 5:00 p.m., to
11 be reconvened on Monday, April 13, 1992, at
12 10:00 a.m.

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